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The Critical Years of the Royal Society, 1672-1703

DOROTHY STIMSON*

SCHOLARS generally are familiar with the forerunners of the Royal Society, with the story of its actual founding and the first brilliant decade of its history. They are aware, especially those who are students of literature, of the ridicule and the satire that greeted much of its early work. To judge by comments made to me, some of them are not so well aware of the continuous existence of this famous institution.

Scientists, on the other hand, recognize the accolade that election to membership in the Royal Society means today, as symbolized by the proud letters F.R.S. after a scientist's name. They think in terms of its importance in modern and contemporary science, with little heed to happenings before the nineteenth century unless they are unusually interested in the history of their own specialties. They may therefore be understandably oblivious of the early history of the Royal Society and, if they consider it at all, suppose that it has always been as it is now, a British association of the leading scientists in all fields which, on occasion, welcomes foreigners and colonials to its fellowship.

But rarely if ever does the scholar or the scientist realize how tenuous and uncertain in the last decades of the seventeenth century was the hold on life of the Royal Society after its first ten years of chartered existence. Would it overcome its various handicaps both from within and from without its membership and grow into successful maturity? For thirty years or more the answer was in doubt. Nor were its difficulties overcome and its full growth accomplished till nearly two hundred years later. What were the handicaps of these doubtful years that hindered its progress after the brilliance of the first ten? This paper attempts to present some of the answers to this question and at the same time to indicate some of the factors in the Society's development.

In summary, the forerunners of the Royal Society are these. Gresham College was opened in 1598 in London to bring to the citizens of that City seven professors who would lecture spring, fall, and winter on

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geometry, astronomy, physic, civil law, divinity, music, and rhetoric. These seven professors, all unmarried, were to have their living quarters as well as their lecture hall in Sir Thomas Gresham's mansion in the city, and there in the gardens and the spacious halls and corridors as well as in their own rooms, were to provide a center of learning for London within its own bounds. Able men from the outset were appointed and a happy combination resulted of academic theory and practical experience, especially for the professors of the sciences. In their audiences, they had captains, navigators, men of affairs with whom to discuss problems from the practical as well as the theoretical aspects, which was what Sir Thomas Gresham desired in his will establishing the College.[1] The College thus became a notable meeting-ground in term-time for men of learning in many professions and occupations,—courtiers, doctors, lawyers, divines, gentlemen of leisure and city merchants. Gresham College in more ways than one was the background for the Royal Society.

By 1645, the famous "invisible college" was meeting,— that informal luncheon club of young professional men with much in common from their university days. They came together weekly to discuss scientific matters with politics, theology, and contemporary news—all matters of bitter controversy at the time—strictly forbidden. Well might this group of ten or more young men prefer to discuss Harvey's newly proved circulation of the blood, Galileo's findings with his telescope, and Torricelli's studies about "vacuities."[2] Among their leaders were Dr. John Wilkins, prominent among the parliamentary supporters, though himself throughout his life a moderate in politics as well as in theology, Robert Boyle, and Theodore Haak, a valuable link with scientists on the continent with whom he was in correspondence, notably Père Mersenne in France.

After the parliamentary victory several from "the invisible college" moved to Oxford in 1649 as appointees to college positions from which the royalists had been ejected. Dr. Wilkins as Warden of Wadham College gathered about him there a notable group of science-lovers ranging from students in the college like Christopher Wren to professors like Seth Ward, and including other friends of theirs who came to Oxford to live, like Laurence Rooke and Boyle himself. In 1651, they

[1] John Ward, *Lives of the Professors of Gresham College, to which is prefixed the life of the founder, Sir Thomas Gresham* (London 1740).

[2] J. Wallis, *Defence of the Royal Society* (London 1678) 7-8; D. Stimson, "Dr. Wilkins and the Royal Society," *Journal of Modern History* 3 (December 1931) 544-47.

organized the Oxford Philosophical Society, keeping regular minutes in addition to imposing the weekly fee of one shilling that "the invisible college" had adopted. The meetings of the Oxford Society became less regular towards the end of Cromwell's rule, especially after Warden Wilkins married Cromwell's youngest sister and was much in London as adviser to Richard Cromwell. After Wilkins had been appointed Master of Trinity College, Cambridge, in 1659, his connection with the Oxford Society ceased, though the Society continued to meet for some time longer.[3]

Meantime the Restoration of 1660 brought Charles II to the throne and the royalists back to the positions from which they had been ejected. Wilkins after eleven months at Cambridge was ejected in his turn, and returning to London rejoined the science-lovers meeting from week to week at Gresham College to hear the astronomy lecture of Christopher Wren or the geometry lecture of Mr. Laurence Rooke. The London science-lovers had continued meeting even during the Commonwealth, despite the departure of some of the group to Oxford or Cambridge. But they had met under difficulties, for part of the time Cromwell's soldiers had used Gresham College as a barracks. The virtuosi had been rather deterred at that lest they too suffer the fate of Archimedes.[4] Now in 1660, the war was over, the king was on the throne, men like Sir Kenelm Digby and Sir Robert Moray were home after their years abroad. Others beside Wilkins and Ward were back from Oxford and Cambridge. Royalist and parliamentarian alike seemed willing to press forward together for the advancement of natural knowledge. In November 1660 the group of science-lovers meeting in Mr. Rooke's rooms after his geometry lecture decided to organize formally if they could secure royal approval.[5]

On July 15, 1662, the Charter passed the Great Seal thus officially establishing the Royal Society. A second charter a year later granted the fellows additional powers and a coat of arms with the motto from Horace supplied by John Evelyn, "nullius in verba" ("Not under bond to abide by any master's authority"). The King presented the Society with a beautiful mace specially made and inscribed, and declared himself both Founder and Patron while the members of that time became the Original

[3] R. T. Gunther, *Early Science in Oxford*, IV, "The Philosophical Society" (London 1925).

[4] Thomas Sprat to Christopher Wren, in Wren, *Parentalia* (London 1750) 254.

[5] T. Birch, *History of the Royal Society* (London 1756-7) I. 3-4; *The Record of the Royal Society* (4th ed., London 1940) 7-8.

Fellows. The weekly fee of a shilling a member was continued with the addition of an admission fee of ten shillings, a few years later to be raised to forty shillings. A president and council of twenty-one members guided the Society, which in 1663 numbered 119 as Original Fellows.[6] Its prospects were great and it made imposing plans for its activities.

But in these first ten years two heavy handicaps under which the Society was to labor for scores of years had already been developed. One was that the members failed to pay the fees assessed and large deficits rapidly accumulated. The other was that less than one-third of these Original Fellows could be called scientists by even the most general definition imaginable. Boyle, Wren, Hooke, Glisson, Willughby, Wallis, Petty were unquestionably scientists, some of them among the greatest of any age. Others, like John Evelyn and even Dr. John Wilkins, actually were science-lovers rather than true scientists, though virtuosi of the noblest type. This disproportion was only natural, for as Boyle once remarked about the members of "the invisible college," "their chiefest fault, which is very incident to almost all good things . . . there is not enough of them."[7] In addition, as some died and others dropped out, their number fluctuated uncertainly.

Actually the Royal Society in the 1660's was a representative company of notable people from the general society of the day, all moved by enthusiasm for experimental philosophy. Poets like Cowley, churchmen like Ward, Wilkins, and Sprat, peers and courtiers like the Duke of Buckingham and Lord Brouncker the first president, politicians, men of affairs, civil servants, even that famous shopkeeper and student of the bills of mortality, John Graunt—all these and many more comprised that first company of science-lovers. We know today little more about many of them than Sprat's description of them as "gentlemen, free and unconfin'd" who "by the freedom of their education, the plenty of their estates and the usual generosity of noble bloud, may be well suppos'd to be most averse from sordid considerations."[8]

Under the patronage and favor of Charles II the popularity of the

[6] These and the following administrative and financial details are taken from the official reports in *The Record of the Royal Society* (4th edition) and from H. Lyons, *The Royal Society, 1660-1940, A History of its Administration and Charters* (Cambridge 1940); Sir Henry Lyons was its treasurer from 1929-39. The translation of the motto from Horace's *Epistles* is that given in I. Masson, *Three Centuries of Chemistry* (New York 1925) 44.

[7] Boyle to Francis Tallents, February 20, 1646/7 in *Boyle's Works* (5 vol., London 1744) I. 20.

[8] T. Sprat, *History of the Royal Society* (2nd ed., London 1702) 67, 68.

young Society attracted many additional members in the next four or five years, including nobles, bishops and archbishops, men of letters and of the professions as well as foreigners of distinction. But by 1668 there came a slackening of new members; in 1669 only five were elected and in the next year four. In 1671 there were six, one of these Mr. Isaac Newton. Then the number swelled again as 17 were admitted.

Thus the membership rolls rose and fell through the last decades of the seventeenth century with the largest increase, 30, in 1681, just after Sir Christopher Wren took the presidency that Boyle had declined. But Sir Christopher had time from his myriad responsibilities to serve for only two years and again the membership slipped until in 1690 exactly one new member was elected. Dr. Hans Sloane becoming secretary in 1693 helped put new life into the Society and by the time Newton was elected president ten years later, a more orderly administration of affairs had been reestablished, the average number of candidates elected in a year was about twelve and gave signs of increasing, and at no time again in its history did the Society fail to maintain its membership. The critical years as regards the number of members had passed; but still the gentlemen outnumbered the truly scientific members more than two to one.

What were the reasons for this uncertain membership? In the 'seventies some of the most energetic and most enthusiastic leaders had died,—Wilkins in 1672 and Moray the next year. Lord Brouncker, its only president for fifteen years, had retired in 1677 and Oldenburg, founder and editor of the *Philosophical Transactions,* had died in 1678. Dr. Richard Lower, the noted physician and a skilled anatomist left the Society about that time; and "thereupon their experiments did in some manner decay," so Wood reports.[9] The Society had survived the interruption of its meetings first by the plague and then by the Fire of London. It had temporarily lost its meeting place in Gresham College which had had to house the Royal Exchange. But, to be sure, Mr. Henry Howard had made the Fellows welcome in Arundel House until they could move back again to the College some seven years later. One wonders too whether the Titus Oates plot of 1678 had affected these virtuosi who were also close to the King? By 1680, attendance at the meetings had so lagged that Evelyn was writing Pepys urging him to come for his "courage and

[9] Cited by K. J. Franklin, "Biographical Notice" xxiv, in Richard Lower, *Tractatus de Corde,* London 1669, in *Early Science in Oxford* (Oxford 1932) IX.

address to encourage and carry on this affair, even if you cannot be there until 6 or 7 o'clock."[10] Would the Society have to disband?

With the Glorious Revolution of 1688 and the coming of William and Mary to the throne, the attendant political uncertainties of those years may help to explain why only one new Fellow was elected in 1690 and why the Society had dropped in membership down to the number of the Original Fellows, only 119, at that time. Furthermore, in the long roll of kings and queens who have signed the charter-book as Patrons of the Society (James II having signed as a Fellow while Duke of York) the names of William and Mary and of Anne are conspicuous by their absence, the only rulers whose names are not there from Charles II to George VI. Probably the Royal Society had been too closely under the patronage of the Stuarts, Charles II, and James II, for William, magnanimous though he was, to bestow his royal favor upon them, or for them to feel comfortably certain of their own future. But Anne, at least apparently, approved of the Society, even though she did not sign the charter-book. She, for example, appointed Newton as president with some of the other Fellows to form the board of visitors for the Royal Astronomical Observatory at Greenwich.

Undoubtedly, financial uncertainties resulting from the decline in the membership and the accompanying deficits contributed to the Society's instability. It had received no state subsidy with its charter. There had been talk of a grant by Charles of some of the confiscated Irish lands but nothing had come of that idea. The King had finally granted the Society the Chelsea Hospital lands in 1669; but the buildings were in very bad repair, lawsuits threatened over various claims to parts of the estate, and tenants were difficult to secure.[11] The gift proved burdensome indeed. Already by the end of the following year the amount owing from Fellows in arrears was £1475 and in succeeding years grew steadily larger. By 1685, the names of more than 60 Fellows had been removed from the lists for having been in default for several years. Not until lawsuits were successfully instituted during the presidency of Hans Sloane in 1727 and 1728 were the finances properly tightened. The King's gift of £1300 in 1682 for the return to the Crown of the Chelsea lands was obviously a major factor in tiding over these difficult years of deficits.

Of course the Society's financial troubles were not unknown. Dr.

[10] Cited by A. Bryant, *Samuel Pepys: The Years of Peril* (New York 1935) 337.

[11] Lyons, *op. cit.* 68, 93.

Henry Stubbe, the most vocal and the most virulent of its critics, was quick to challenge the Society in 1670 to publish the number of active members who report thither and who pay the usual contribution. He claimed that sober and serious men had deserted it because the comic wits, as he termed the Fellows, had so deviated from their original purpose.[12]

Financial troubles within and political unrest without were not the only factors affecting the membership situation. The members themselves in their naive enthusiasm for the new philosophy had what we might call today a lunatic fringe who provided ample material for the wits and satirists to use. We now know that Dr. Hamey, a fellow and a benefactor of the Royal College of Physicians, jealous for his own College because of the anatomical studies made by the early Royal Society, secretly employed Dr. Stubbe to attack the Society at every point.[13] But what the Society's contemporaries saw was that Dr. Henry Stubbe whom Anthony Wood characterized as the most noted person of his age, also the most noted Latinist and Grecian, "took a pet against the Royal Society," as Wood expressed it, and through his writing made himself its most inveterate enemy.[14] He accused the Society of intending to bring contempt upon ancient and solid learning and upon Aristotle. These virtuosi, he asserted, were seeking to undermine the universities and to reduce them to nothingness, or at least to make them inconsiderable. They were seeking to destroy the established religion and to involve the nation in popery "and I know not what." So alarmed was he, as he claimed, that he was willing to hazard his life and fortunes in pointing out these dangers. He pounced upon Sprat's *History of the Royal Society* and on the enthusiastic books of the young Joseph Glanvill, an ardent supporter of the new experimental learning, challenging their arguments unmercifully. He made much of the laughter aroused among men of true learning and no strangers to mathematics by the proposals some made of flying to the world in the moon. He attacked the transfusion experiments asking "what regulations shall we have for this operation, shall a man transfuse he knows not what, to correct he knows not what, God knows how?"[15] His attacks were shrewd for his learning was great; but

[12] H. Stubbe, *Plus Ultra Reduced to a Non Plus* (London 1670) "To the Reader."

[13] H. Brown, *Scientific Organizations in Seventeenth Century France* (Baltimore 1934) 256-57.

[14] A. Wood, *Athenae Oxoniensis* (ed. P. Bliss, 4 vol., London 1817) 1067, 1070-71.

[15] Stubbe, *op. cit.* 40, 153; Wood, *op. cit.* 1071.

his language was intemperate and at times scurrilous, and his common sense and sobriety so lacking that he made himself and his learning cheap. For example, to Robert Boyle, already one of the most distinguished and respected of the virtuosi, Stubbe wrote in 1670: "All men apprehend it now that their common interest is to oppose the Royal Society. I know not what any physicians may, as the mode is, tell you to your face; but except it be Dr. Sydenham and young Coxe, I believe that not one lives that doth not condemn your experimental philosophy."[16]

Joseph Glanvill was not easily silenced. He joined the fray with further books and pamphlets pointing out that Stubbe had ignored Bacon's philosophy and had failed to note that the experimental philosophers were attacking not the ancients but their method. Glanvill pointed up one attack by asking, in reference to Stubbe's hair, "I said your head was red-*hot*. Why did you make yourself ridiculous at Oxford by plucking off your periwig and showing your head to every freshman to demonstrate your charge of lying against me?"[17] One can well imagine the Society's relief when Stubbe's bitter pen was stilled by his accidental death in 1676; for not many of the Fellows could have been as serene under his whiplash of scorn and vituperation as Evelyn was when he wrote to Glanvill congratulating him upon his vindication of himself and "of all useful learning against the science (falsely so-called) of his snarling adversary." Evelyn went on:

> I do not conceive why the Royal Society should any more concern themselves for the empty and malicious cavils of these delators, after what you have said; but let the moondogs bark on, till their throats are dry: the Society every day emerges, and her good genius will raise up one or other to judge and defend her; whilst there is nothing which does more confirm me in the nobleness of the design, than this spirit of contradiction which the devil (who hates all discoveries of those false and prestigious ways that have hitherto obtained) does incite to stir up men against it.[18]

It seems unlikely that his contemporaries knew that Dr. Henry Stubbe was well paid for his attacks upon the new science and the virtuosi, and that jealousy of the young Society's growth and range of activity was behind his virulence. But Stubbe was not the only learned critic. Dr. South, the university orator, made a long speech on the occasion of the dedication of Oxford's Sheldonian theater, July 9, 1669. As Dr. John Wallis summed it up for Boyle in a letter:

[16] Stubbe to Boyle, June 4, 1670 in *Boyle's Works* I. xcv.

[17] [J. Glanvill] *A Further Discovery of Mr. Stubbe* (London 1671) 27-28.

[18] *Diary and Correspondence of John Evelyn,* (ed. W. Bray, 4 vol., London 1891) III. 204.

The first part consisted of satirical invectives against Cromwell, fanaticks, the Royal Society, and new philosophy; the next of encomiasticks in praise of the archbishop, the theater, the vice-chancellor, the architect and the painter; the last, of execrations against fanaticks, conventicles, comprehension, and the new philosophy, damning them *ad inferos, ad gehennam.*[19]

The only direct quotation that I have been able to find from that speech is given by Isaac D'Israeli, in 1814. He quoted Dr. South's comment on the virtuosi on that occasion as "They can admire nothing but fleas, lice and themselves."[20] Not only were several at least of the Fellows in the audience that day but even the architect, Wren, and the donor of the building, the archbishop himself, were Fellows also!

Sprat in his *History* (1667) had already noted these charges and had sought to allay them by his presentation of the Society's work:

Some over-zealous divines do reprobate natural philosophy as a carnal knowledge, and a too much minding worldly things, [while on the other hand] the men of the world and business . . . esteem it merely as an idle matter of fancy and as that which disables us from taking right measures in humane affairs. . . . The greatest part of men are still apprehensive; if they can bring such inquirers [into experimental philosophy] under the scornful title of Philosophers, or Scollars, or Virtuosi, it is enough: they presently conclude them to be men of another world, only fit companions for the shadow, and their own melancholy whimsies.[21]

However, the learned arguments of such as Stubbe and South were apparently less feared by the virtuosi than the ridicule and laughter of the wits and the ballad-makers. Students of literature are well aware of Pepys' concern about such dangers in the proposed visit of that remarkable genius and exceedingly eccentric great lady, Margaret, Duchess of Newcastle, who had asked to be invited to a meeting of the Royal Society. Despite the opposition of many of the Fellows, she came in great pomp, as Evelyn reported, but failed to impress Pepy at all, for he did not hear her say anything that was worth hearing. "She was full of admiration, all admiration." Evelyn, on the other hand, had been earlier that spring much pleased by "the extraordinary fanciful habit, garb and discourse of the duchess" when he had called upon her and the duke.[22] However, if any ballads followed her visit to the Royal Society, I have failed to find any trace of them.

Sprat, like Pepys, had the "wits and railleurs" of his age much on

[19] *Boyle's Works* V. 514.

[20] I. D'Israeli, *Quarrels of Authors* (3 vol., London 1814) II. 21.

[21] Sprat, *op. cit.* 26-7.

[22] Pepys, *Diary*, ed. H. B. Wheatley (8 vol., London 1926) VI. 324 (May 30, 1667); Evelyn, *Diary* II. 24 (April 18, 1667).

his mind, hoping, as he wrote, to win them over to make common cause with the Royal Society; for

> if they shall decry the promoting of experiments, they will deprive themselves of the most fertil Subject of fancy. And indeed it has been with respect to these terrible men that I have made this long digression [on the inexhaustible treasure of natural knowledge for the wits]. I acknowledge that we ought to have a great dread of their power. I confess I believe that New Philosophy need not (as Caesar) fear the pale or the melancholy as much as the humorous and the merry. For they perhaps by making it ridiculous, because it is new, and because they themselves are unwilling to take pains about it, may do it more injury than all the arguments of our severe and frowning and dogmatical adversaries.[23]

The Fellows protected themselves as best they could. In 1668 they ruled that records or notes of discoveries from outsiders, not Fellows, must first be shown to the president before they could be accepted, so Oldenburg wrote Boyle, "for fear of lodging unknownly ballads and buffooneries in these scoffing times."[24] However, the King himself had laughed at their concern over the weight of the air. What could seem more fantastic than the proposed flights to the moon or anywhere else? The *Philosophical Transactions* published by Oldenburg monthly from 1665 on contained many equally strange and fantastic inquiries and investigations undertaken by the Fellows.

What Sprat feared came to pass all too soon. Samuel Butler, Mrs. Aphra Behn, and Thomas Shadwell were three of the most brilliant satirists who used this reservoir of experimental learning not, as Sprat had hoped, for their flights of noble fancy, but for attacks of scathing wit and irony against the virtuosi and their activities. Butler to some extent differentiated between the enthusiast in pursuit of the new, no matter how extreme, and the true science-lover possessed of some common sense. The other two lumped both together as the common victims of their barbed attacks.

Butler's famous "Elephant in the Moon," though written some time in the 1660's or '70's, was not printed till 1759, together with a fragment of poetry on the Royal Society that was even more scathing. In the poem Butler contrasts the ignorant but sensible footman who honestly says he sees something—a mouse—in the tube of the telescope and the virtuoso willing to listen to his comment and to investigate the tube itself, with the absurd virtuoso who is certain he sees armies battling

[23] Sprat, *op. cit.* 417.

[24] Oldenburg to Boyle, January 18, 1667/8, *Boyle's Works* V. 381.

on the moon and even elephants of gigantic size striding across its surface. Thus Butler condemns . . . .

> . . . those who greedily pursue
> Things wonderful, instead of true; . . .
> Hold no truth worthy to be known
> That is not huge and over-grown,
> And explicate appearances,
> Not as they are, but as they please,
> In vain strive Nature to suborn
> And for their Pains are paid with Scorn.

It is from the Fragment that the still more famous lines are taken:

> These were their learned speculations
> And all their constant occupations:
> To measure wind and weigh the air
> And turn a Circle to a Square . . .
> If Chymists from a Rose's ashes
> Can raise the rose itself in Glasses . . .
> To stew th' Elixir in a bath
> Of Hope, Credulity, and Faith.[25]

Were these verses known in Butler's lifetime? They were not printed till 1759, long after his death in 1680. Were they passed around by word of mouth or from hand to hand? Was Butler one of the "terrible men" whose mockery Sprat dreaded?

Far more deadly in its ridicule and less discriminating between the best virtuosi and the credulous enthusiasts was Thomas Shadwell's play, *The Virtuoso,* produced and also published in 1676. In this Shadwell created the famous character, Sir Nicholas Gimcrack, supposedly representative of the scholars absorbed in the new science without any differentiation between the true scientist and the false enthusiast. In the vocabulary of the *Philosophical Transactions,* Shadwell composed the dialogues, taking his material from that journal, from Sprat's *History,* and from Hook's *Micrographia,* and adding his own twist to what he used. Parodying the Society's study of insects and the tests made on the supposed "eels in vinegar," he added stings to the eels' tails which gave vinegar its bite. He parodied the experiments on transfusion by recounting a transfusion of a spaniel into a bulldog. Whether the studies were of the density of the air, the topography of the moon, or the possibility of flights by man, by carrying them to fantastic extremes he made scientific obser-

[25] S. Butler, *Genuine Remains in Verse and Prose* (London 1759) 1-53, 53-56.

vation absurd. As Claude Lloyd remarks: "The laugh was on the experimental science of the Royal Society."[26]

It was also on the experimenters themselves, for Sir Nicholas Gimcrack lived on in literature, and certainly none of the virtuosi would care to be thought to have sat for his portrait. Various characters in the play take their turn in describing him as

> the finest speculative gentleman in the whole world . . . not a creature so inanimate to which he does not give a tongue; he makes the whole world vocal; he makes flowers, nay weeds, speak eloquently and by a noble kind of prosopopoeia instruct mankind.
>
> [He has spent] 2000 pounds in microscopes to find out the nature of eels in vinegar, mites in a cheese, and the blue of plums; which he has subtilly found to be living creatures. . . . [He has] broken his brains about the nature of maggots, who has studied these twenty years to find out the several sorts of spider, and never cares for understanding mankind.

His wife described the well-known swimming lesson:

> He has a frog in a bowl of water, tyed with a packthread by his loins; which packthread Sir Nicholas holds in his teeth, lying upon his belly on a table, and as the frog strikes, he strikes, and his swimming master stands by to tell him when he does well or ill.

Sir Nicholas himself remarked he "hates the water and never comes upon it"; he is content "with the speculative part of swimming, and cares not for the Practick. I seldom bring anything to use; tis not my way. Knowledge is my ultimate end."

In this, perhaps, the most deadly of all the attacks upon the Society, Shadwell presented a picture of the virtuoso as a

> crank, superstitious and gullible, and interested only in the eccentric or monstrous; a sham philosopher, vain and shallow, whose ostensible love of learning was at root but an idle curiosity, and whose learning itself was studiously divorced from practical reality.[27]

And the play was immensely popular.

Only less deadly was Mrs. Aphra Behn's farce, *The Emperor of the Moon,* which was produced in London in 1687, and was long a favorite. Parodying the vocabulary of the virtuosi and their fantasies about people inhabiting the moon, the plot concerns the daughter and the niece of one of the virtuosi, a doctor, who has restricted the girls too closely.

[26] T. Shadwell, "The Virtuoso," *Works* (4 vol., 1720) I. 341, 344 ff; C. Lloyd, "Shadwell and the Virtuosi," *Pub. Mod. Lang. Assoc.* 44 (June 1929) 472-94.

[27] T. Shadwell. *op. cit.* I. 321, 324, 331, 340-343; N. Pearson, "The Virtuoso," *Nineteenth Century,* 66 (November 1909) 859.

Scaramouche, disguised as a man from the moon, helps the two lovers, similarly disguised, to fool the doctor and get access to the girls. The plot was slight, but there were dances and songs to add attractiveness to the ridicule of contemporary interest in lunar phenomena and their interpretation.[28] The virtuosi were again the victims.

Does not the fact that just one Fellow was elected to membership in the Royal Society in 1690 reflect not only disturbed political conditions, but also the cumulative effect of such brilliant satire as Shadwell's and such clever mockery as Mrs. Behn's? Who would want to be considered a Sir Nicholas Gimcrack himself? Some support for this idea may be found in William Wotton's *Reflections upon Ancient and Modern Learning*, first published in 1694. He wrote:

> Though the Royal Society has weathered the rude attacks of such as Stubbe who endeavour'd to have it thought that study of natural philosophy and mathematics was a ready method to introduce scepticism at least, if not atheism, into the world: yet the sly insinuations of the Men of Wit that no great things have ever or are ever like to be perform'd by the men of Gresham and that every man whom they call a virtuoso must needs be a Sir Nicholas Gimcrack, together with the public ridiculing of all those who spend their time and fortunes in seeking after what some call useless natural rareties, who dissected animals, little as well as great, who think no part of God's workmanship below their strictest examination and nicest search; have so far taken off the edge of those who have opulent fortunes, and a love of learning, that physiological studies begin to be contracted amongst physicians and mechanics. For nothing wounds so much as a jest; and when men do once become ridiculous, their labours will be slighted and they will find new imitators. How far this may deaden the industry of the philosophers of the next age is not easie to tell.[29]

But the industry of the philosophers of that last quarter of a century had not been deadened, despite the wounds of jesters, financial difficulties, a shrinking membership, and political turmoil. Even during the first years the Society had survived triumphantly direct political danger. The arrest and imprisonment in the Tower in 1667 of Oldenburg, its indefatigable secretary, "for dangerous designs and practices" had only given him pause for a short breathing-spell before he resumed his insistent letter-writing, urging his correspondents to support the Society's work in every way that would promote the advance of natural knowledge.[30] Thereafter, despite all uncertainties, the Royal Society had continued to lay the foundations of its future greatness. Between 1672 and 1700 it had published or sanctioned the publication of eighteen scientific works,

[28] A. Behn, *Works*, ed. M. Summers (London 1915) III. 388, 390-497.

[29] W. Wotton, *Reflections upon Ancient and Modern Learning* (2nd ed., London 1697) 419.

[30] Oldenburg to Boyle, September 3, 1667, *Boyle's Works* V. 364.

not including the *Philosophical Transactions* which Hooke continued after Oldenburg's death. These publications ranged from Nehemiah Grew's *Catalogue and Description* of the Royal Society's collections to Francis Willughby's *Historia Piscium,* Marcello Malpighi's *Opera Posthuma,* and Newton's *Principia.*[31] Thus the Society had already well begun its great work of furthering the advancement of science by aiding both foreigners and Englishmen to make their work known. It was through letters to the Royal Society, translated and printed in the *Philosophical Transactions,* that the Dutchman Leeuwenhoek, for example, was informing the world of science about his discovery of amazing little animalcules in a drop of rain-water.

As a Society, the Fellows also were furthering scientific undertakings proposed by the state. Lack of funds had prevented them from taking up a suggestion for a geodetic survey made by Charles II soon after the Society was founded. But when Charles established the Royal Observatory at Greenwich in 1675, it was on the advice and with the encouragement of some of the Fellows. Wren suggested the site and planned the building, but characteristically Charles granted a fund for building and a salary for the astronomer without provision for equipment or for expenses. Flamsteed, the first Royal Observator, had to provide his own. The Society lent Flamsteed telescopes and other equipment during those first years. They also published for him his *Tide-Table for 1687.* Queen Anne's appointment of Fellows as a Board of Visitors set a pattern that has been followed with modifications ever since.[32]

Consultation by the government with the Society on scientific matters, begun by Charles II, has been continued and developed throughout the centuries. Its committees have directed the spending of research funds. In 1940 such special funds numbered close to sixty and the total amounted to well over a million dollars.[33] The Fellows have been named advisers or trustees for other government organizations besides the Royal Observatory. Since the days of George IV they have named annually the recipients of the Royal Medals for the most important contributions to the advancement of knowledge published originally in the King's dominions.

Beside this close association with the state, the Society developed

[31] *Record of the Royal Society* (1940) 37-38.

[32] *Ibid.* 46-47; A. Armitage, "Our First Astronomer Royal—The Tercentenary of John Flamsteed," *Science Progress* 135 (July 1946) 510, 513.

[33] Lyons, *op. cit.* 305-307.

two enterprises in its difficult years that became of basic importance in the growth of the British Museum. In 1663 the Fellows had started the Society's repository or museum by presenting to it rarities, or specimens of natural phenomena. They had even employed a collector for a time to go through England and gather together curiosities of all sorts for their repository. By 1681 these collections had grown to such an extent that Dr. Grew's catalogue and description of them filled a folio book of about 450 pages and listed by name 83 donors, including the East India Company and the Royal Africa Company.[34] But a hundred years later, when the Society was moving from Crane Court, where it had been since 1710, to rooms provided by the government in Somerset House, the problem of space for the collections became urgent. The Council in 1779 offered them to the trustees of the British Museum, thus adding to the Museum what had been throughout that century the most important and the largest museum of its kind in London, a "considerable donation" for which the trustees were very grateful.[35]

Similarly the Society from the outset had used books as sources for questions to be investigated and for the experiments that had been tried, but not, as Sprat expressed it, to have "a professorian philosophy."[36] When the City authorities borrowed Gresham Mansion and the Society moved temporarily to Arundel House, John Evelyn saw volumes from the great ancestral library disappearing as people took what they fancied. He therefore urged Mr. Howard to give his library to the Society.[37] This was done, and the books were transferred to the Royal Society's library in Gresham College in 1678. They included 544 volumes of manuscripts as well as 3287 printed books. This gift may have persuaded Sir George Ent, another first Fellow, to add his own library to the Society's, which he did a year later. Then too, as the Fellows published their own books, they usually presented a copy to the Society's library, with the result that almost from the outset the Society possessed a valuable collection of books which has since steadily grown in size and importance. In 1830, with the consent of the Duke of Norfolk, the manuscripts in the Arundel collection were transferred to the British Museum and their value, £3559, was used to purchase English and foreign scientific works for the Society's

[34] N. Grew, *Musaeum Regalis Societatis* (London 1681) 388.

[35] Lyons, *op. cit.* 210-11.

[36] Sprat, *Observations on Mons. de Sorbière's Voyage into England* (London 1665) 242.

[37] Evelyn, *op. cit.* II. 22 (January 9, 1666/7).

own library.[38] Thus the library became of even greater usefulness and at the same time the British Museum again profited.

Furthermore, during these early critical years the Society served as an international clearing-house for scientific discoveries and ideas of all sorts, a service that has continued ever since. Foreigners and colonials as well as the English themselves sent in their books, reported notable phenomena or ingenious inventions, asked for advice and criticism, and gladly accepted election to membership. By 1697, when the total number of Fellows was only 121, twenty-four of these were foreign members.

Isaac Newton, a Fellow since 1671, moved to London in 1696 as Warden of the Mint. Three years later he was made Master. But not till after the death of Robert Hooke early in 1703 did he accept the presidency of the Royal Society, an office which he then held until his own death in 1727.[39] Newton's prestige, and his regular participation in the Society's business, combined with the improved administration already begun ten years earlier by Dr. Hans Sloane, as secretary, started the Society under his presidency upon the second phase of its history—a phase that lasted till its inner reorganization during the 1830's and '40's brought about the Society as we know it today. But its problems, even with Newton as president, were not all settled nor were the tongues of the satirists stilled. Shadwell and Butler had only given way to Addison, Steele, and Swift. Most important of all, the true scientists continued to number less than one-third of the total membership and to be in the minority on the all-powerful governing body, the Council. There were times during the 18th century when not a single one of the Society's officers was a scientist.[40]

Even so, the very existence of the Society was never again in question. Finally, after its reorganization by insistence upon scientific achievement as a basis for membership, the scientists in the Victorian era gained full control and in consequence the Royal Society developed into the great association it is today. While the pens of Sprat's "terrible men" have long since been stilled, evidently they are not yet wholly forgotten. In 1945, the first women[41] were elected to membership, but over the protests of ten per cent of the Fellows.[42]

[38] Lyons, *op. cit.* 249.

[39] *Ibid.* 119-20.

[40] *Ibid.* 189.

[41] Kathleen Lonsdale (London), physicist, Royal Institution, and Marjorie Stephenson (Cambridge), member of the scientific staff of the Medical Research Council.

[42] H. Dale, P.R.S., "Address at Anniversary Meeting. November 30, 1945," *Proc. Roy. Soc.* Series B, 133 (February 12, 1946) 130.

Medical Matters in an Early Fourteenth Century Chinese Diary

R. C. RUDOLPH*

CHINESE literature abounds with works which afford us ample opportunity to study the history and theory of Chinese medicine, but they give scarcely any information on the part played by medicine in the daily life of the people. I have come across some such information in the diary of an early fourteenth century Chinese artist while searching the document for observations pertinent to the art history of that period.[1] These observations of a medical nature have been culled from the diary and are presented here in the hope that they may be of interest to students of medical history.

In their classification of literature, the Chinese place medical writings under the general division of philosophy, the other main divisions being classics, history, and belles-lettres. A good-sized bookseller's catalogue arranged according to this traditional classification will invariably have over one hundred titles in the subdivision devoted to medicine. *T'u shu chi ch'eng,* the great illustrated Chinese encyclopedia containing several times the material in the *Encyclopaedia Britannica,* devotes 540 chapters to medical matters including biographies of physicians. Chinese medical writing can also claim a respectable antiquity, for the bibliographical section of the *Han shu* (*History of the Han Dynasty*) compiled in the first century A.D. contains the titles of eighteen works devoted to the medical arts.[2]

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[1] The name of this diary is generally given as *K'o hang jih chi* (*Daily Record of a Visit to Hangchow*). There are several editions of the diary known to me of which all but one are abridged. The unabridged edition used in this study is found in the collection *Ku hsüeh hui k'an* and bears the title *Kuo T'ien-hsi jih chi (Kuo T'ien-hsi's Daily Record).* References are made to dates rather than to pagination because the former will be uniform in all editions.

[2] *Han shu,* ch. 30, pp. 50b-51b (edition of 1739). These eighteen works contain 490 chapters and were apparently in the imperial library or archives at the time of the compilation. Medical literature fortunately was not included in the great Burning of the Books in 213 B.C. by the first emperor of the Ch'in dynasty. By the early seventh century at the close of the Sui dynasty (589-618), the number of medical works in the official annals had risen to 256 titles in 4510 chapters (*Sui shu,* ch. 34, pp. 28b-35a). For a sketch of Chinese medical literature, see Wong and Wu, *History of Chinese Medicine* (2nd. ed., Shanghai 1936) 28-30, 80-85, 169-177, and E. H. Hume, *The Chinese Way in Medicine* (Baltimore 1940) 130.

But even with this great body of medical literature, we must resort to the less technical works such as diaries, travel accounts, and miscellaneous notes in order to understand the attitude of the public toward medicine in early China.

Our diarist was an artist with political ambitions, and his journal is largely concerned with his attempts to secure an official post in the government educational system. It was written during the first and second years of the Chih Ta period of the Yüan or Mongol dynasty which corresponds to 1308-1309 in western chronology.[3] His family name was Kuo and his given name Pi, the surname regularly preceding the given name in Chinese. His sobriquet was T'ien-hsi, and he is commonly known both as Kuo T'ien-hsi and Kuo Pi. Like any self-respecting Chinese artist he had several brush names, but these need not concern us here. His home was at Chen-chiang (Chinkiang) on the Yangtze River, about fifty miles downstream from the present national capital of Nanking.

Kuo does not compare with England's Pepys in the latter's inimitable account of manners, customs, and politics, and it is most regrettable that he does not. Again, as far as wealth of material is concerned, Kuo's diary is also surpassed by the diary of Marco Polo who visited Hangchow only a few years before Kuo,[4] but in this case the value of the latter lies in his more sober and matter of fact observations. The notices are short, and are couched in a terse and sometimes abstruse style. His diary gives the impression of having been an aide memoire meant for his own eyes, and it does not contain entries intended for the information or amusement of posterity. It is essentially a day to day record of people who called on him and people he visited, his travels on the Grand Canal between Chen-chiang and Hangchow, pictures seen (many now lost) and artists met, pictures painted by himself, and his frequent visits to Buddhist and

[3] The Chinese at that time were using the lunar calendar; hence the months are lunar months and do not correspond exactly with our present twelve months. The catalogue cards of the Harvard-Yenching Library and other reference works give the birth and death dates of Kuo Pi as 1301 and 1355. The latter date may be correct, but the birth date is obviously wrong because it goes without saying that no one who was born in 1301 would be an accomplished artist, author of such a diary, and seeker of a government post at the tender age of eight years.

Moreover, an appendix to the unabridged diary (*Kuo T'ien-hsi jih chi fu lu*) gives a number of colophons to paintings, etc., written by Kuo, and some of these show that he was active around 1290. Although it would be desirable to know Kuo's age at the time he wrote the diary, it is not of prime importance here and will be treated elsewhere.

[4] See Leonardo Olschki, "Medical Matters in Marco Polo's Description of the World," *Bull. Hist. Med.* Supp. No. 3 (1944) 237-59. This interesting paper suggested the title of the present essay.

Taoist shrines and temples. Like most diarists the world over, he also gives us a daily record of the weather.

Kuo is not a famous artist, and although the Chinese have taken cognizance of him, western writers on Chinese art have left him unnoticed. At least three of his pictures have been preserved and one of these, dated 1339, was exhibited by the Chinese Government at the great Exhibition of Chinese Art held in London in 1935.[5]

In addition to the most frequently mentioned topics enumerated above, there is other incidental information that is of no small interest. This includes notices on ancient bronzes and other archeological objects, food, divination, festivals, parties, games, members of his family, and medical matters. For the purpose of this paper it is proposed to include in the last category such topics as illness, medicine and prescriptions, doctors, drug shops, and diet.

Illness. 1308, 10th month, 23rd day: While in Hangchow an acquaintance of his had an attack of malaria and Kuo took him to a doctor. 1309, 4th month, 5th day: Made inquiries about a relative by marriage who was suffering from an unspecified illness. 7th month, 23rd day: At home in Chen-chiang he visited a friend who had returned from Hangchow ill with malaria. The Chinese character that has been translated here as malaria is also used for febrile ailments in general, but its specific and most common meaning is malaria. This character plus that for mosquito is the Chinese equivalent for the anopheles mosquito.

In this connection, it is interesting to note that Kuo was so plagued at times by mosquitoes that he frequently mentioned them in his diary. 1308, 9th month, 19th day: He stayed overnight at P'ing-chang[6] en route to Hangchow and ended the day's notice with "there were many mosquitoes this evening." In the 6th month of 1309 the mosquitoes were very bad, especially in and around Hsing-hua[7] where Kuo visited for several days to renew acquaintances. 2nd day: He arrived in Yangchou (Kiangtu) about 15 miles north of the Yangtze on his way to Hsing-hua and "spent the night in the shop [of a friend]; the numer-

[5] It is reproduced in the *Illustrated Catalogue of Chinese Government Exhibits for the International Exhibition of Chinese Art in London* (Shanghai 1936) 168. The same painting and two others are in Harada, *The Pageant of Chinese Painting* (Tokyo 1936), pl. 307-309.

[6] The present city of Suchow in Kiangsu province, reached on the third day of his boat trip down the Grand Canal. A very interesting account of a trip by the canal from Hangchow to Peking as described in a diary of 1276 is given in *T'oung Pao* 16 (1915) 393-419.

[7] Also spelled Hinghwa. It is in Kiangsu province, about 60 miles north of his home town of Chen-chiang on the Yangtze River.

ous mosquitoes made it impossible to sleep in peace." The following night he found relief at Kao-yu,[8] the next stage of his journey. He spent the night aboard ship and, although it was very warm, there were no mosquitoes. The next day, however, he reached Hsing-hua and complained bitterly about the size and ferocity of the "extreme number of mosquitoes" and wrote, no doubt with scarred and swollen hand: "At night I do not dare to close my eyes until I have erected a mosquito net." 14th day: After a merry outing spent in visiting temples, boating, and drinking wine from cups made out of lotus leaves, he says: "This day was indeed a gay one, but the innumerable mosquitoes took the pleasure out of it." The entry for the 17th day shows his growing concern with the mosquito problem: "Every night it is extremely hot and the sweat stands out on one like rain. The mosquitoes of Hsing-hua are not only big, but their proboscises are very sharp." The next day, the 18th, poor Kuo could not even find relief from them on the water: "In the evening the heat was unbearable so Mr. Chan got a boat and we went out on the river to take advantage of the coolness there, but were so distressed by the mosquitoes that again they put an end to our pleasure." The next day it became cooler and there is no mention of mosquitoes until the 25th. That day he left Hsing-hua and returned to Kao-yu where he felt considerably relieved; not only because he was cheered by the cool evening air but also because "compared with Hsing-hua there are no mosquitoes."

Several times Kuo mentions illness among the male members of his family. In the 8th month of 1309, for example, he took one of his brothers to a doctor on two successive days before he could find the doctor in. Even after obtaining medicine the next day his brother was "feverish and coughing." Kuo was apparently alarmed over the symptoms, for he set out in search of the doctor and took him back home with him to treat his brother.

The diary records the death of only two people in conjunction with specific ages. But even these two cases, because of their youth and the proximity of their deaths, and because of other deaths about the same time, may possibly indicate epidemic conditions. The possibility of coincidence, however, must not be overlooked. In the 4th month of 1309, practically the only place where death is mentioned, we have the following entries. 1st day: Records the death of a young friend. 3rd day:

[8] Kao yu is about 55 miles north of Chenchiang on the Grand Canal. For technical and historical information on the mosquito problem in China, see L. C. Arlington, "The Mosquito Scourge," *China Journal* 6 (1927) 243-47.

Speaks of a group of "stout fellows who in less than half a month all became ill and died." 9th day: Goes to condole with a friend whose son-in-law died. The following day he attended the funeral. 13th day: Hears from a passing Taoist priest that a friend "has become immortal. How sad! How sad! He was just thirty years old." 17th day: hears that another acquaintance "has become immortal." He was "twenty-two years old, humble, and fond of study. How lamentable!" Kuo attended his funeral next day.

Medication. 1308, 10th month, 23rd day: Kuo took an acquaintance suffering from malaria to get some medicine from a doctor. As an example of early Chinese prescriptions for treatment of malaria, the following has been extracted from the *T'ai po yin ching,* an eighth-century work on military strategy. [Ground] turtle-shell, 3 oz., [root of] orixa japonica, 2 oz., liquorice root, 2 oz., usnea longissima, 2 oz., simmered with black plums and given orally. 1309, 1st month, 20th day: While at a social gathering he obtained from one of the guests a prescription for scabies. 2nd month, 3rd day: He obtained some medicine from a certain Chang T'ing-yü, probably a doctor, who is frequently referred to in connection with medical matters. This medicine was undoubtedly for a younger brother who was examined some days earlier by the same Mr. Chang. 9th month, 18th day: Kuo mentions a "tooth medicine" made from the litchi (Nephelium litchi). The great Chinese materia medica, the *Pen ts'ao kang mu,*[9] which was compiled by Li Shih-chen from a large number of herbals and medical treatises during the years 1552-1578 contains two such recipes for toothaches. The first says that if an unshelled litchi is roasted, reduced to a powder, and applied to the tooth, the pain will stop. The second one says that the shell of a large litchi should be filled with salt, heated, powdered, and applied; improvement will follow.

Doctors. As mentioned before (1308, 10th month, 23rd day), while in Hangchow he took a friend who had malaria to T'ang Pei-ts'un, apparently a doctor, for medicine. Two days later he met Su Ch'un-chai, a skilled Hangchow medical doctor, and had a drink with him in the market-place. On the 4th day of the 11th month, Kuo boarded ship at Hangchow for his return home and on board met the court physician

[9] Ch. 31. On the various editions of this work, and an original edition of a Chinese herbal printed in 1249, see A. W. Hummel, *Annual Report of the Librarian of Congress for the fiscal year ended June 30, 1940,* 155-157; reprinted in *Isis* 33 (1941) 439-442. Cf. Wong and Wu, *op. cit.* 105-109, which also refers to partial translations of this work.

Ch'u. Eight days later while stopping over at Ch'ang-hsing[10] he was visited by "Shen, superintendent of medical studies." Medical education began very eary in China but suffered reverses from time to time. Government medical schools were revived by Imperial decree in 1262 and were flourishing in Kuo's time, and state medical examinations were reintroduced before his death.[11]

After returning to his home on the Yangtze he met the court physician Li Ho-chih.

In the first month of 1309 Chang T'ing-yü came to examine a younger brother's pulse, and nine days later Kuo obtained some medicine from the same person. 8th month, 9th day: Kuo took his "fifth brother" to see Chang T'ing-yü but he was not in. The reason for the visit is not stated but it was probably for medical advice, because he took the same brother to Chang the next day and Chang felt his pulse and prescribed medicine for him. Either the diagnosis by pulse was incorrect or the medicine was not efficacious for the next day, the 11th, Kuo writes: "Fifth brother feverish and coughing, so I got on a horse to hunt for Chang. I met him on the road and brought him back to our house where he administered medicine." Two days later Chang T'ai-chai (which could be another name for Chang T'ing-yü) came to examine the pulse of a younger brother. On the 6th day of the 10th month in company with a younger brother he "visited Chang T'ai-chai and met Hsing Tzu-cheng, a physician from the North. Chang examined younger brother's pulse." Younger brother was obviously in good health three days later for he was drinking wine and eating boiled crab at a party with Kuo. Four days later Kuo was in Chang's office again with another younger brother who also had his pulse felt. On the 18th of the same month, Kuo, apparently alone, tried to see Dr. Chang but he was out. He does not say whether he went to pay the family bill or whether he was actually ill, but at any rate he spent the rest of the day visiting around the town and stayed up late that night chatting with two old friends. The next day Kuo called on Dr. Chang again but once more this worthy must have been out visiting patients for he was not in his office. Probably in despair of ever finding Dr. Chang in or getting an appointment with him, Kuo

[10] Ch'ang-hsing is in Chekiang province near the southwest shore of Lake T'ai Hu. Kuo made a detour by branch canals from the direct Grand Canal route to spend a number of days in Ch'ang-hsing with friends.

[11] Wong and Wu, *op. cit.* 97.

and his friend Ch'en "drank at the Han tavern until evening when I was drunk."

Examination of the pulse has been the most popular of diagnostic methods in China for many centuries. It is recorded that Pien Ch'iao (fifth century B. C.) was the first exponent of sphygmology and many works have been written on this subject.[12]

Unfortunately, available Chinese biographies of famous physicians of this period do not include any of those mentioned in Kuo's diary.

Drug Shops. These were for all intents and purposes herb shops, since herbs have always been the most important element of the Chinese materia medica. In fact, the Chinese character read *yao* basically means "herbs" but it is the usual term for "medicine." Other things, however, such as animal extracts and ground "dragon bones"[13] were also widely used. It is suspected that these shops may also have been something of a social center because on several occasions Kuo writes about meeting friends at drug shops and having tea at them, with no mention of medicine. Others are mentioned immediately after a visit to the doctor or with the express purpose of having a prescription filled. Sometimes the medicine was obviously prepared and dispensed by the physician himself. This was the case (1309, 2nd month, 3rd day) when Kuo made a trip to the home of a doctor to pick up medicine for a brother who had been examined by this doctor nine days before. Most of the pharmacies mentioned by Kuo are named after individuals but at least one bears the intriguing name of "Secluded Dwelling Drug Shop."

Diet. Kuo Pi apparently enjoyed a diet which was unrestricted either by physical afflictions or spiritual convictions. Among the foods he mentions are fish, fried fish, broiled fish, dried fish, fish sauce, boiled crab, mutton, "fat donkey meat," pig's feet, chicken, boiled chicken, roast chicken, goose, rice, noodles, fried noodles, steamed dumplings, steamed

[12] For a sketch of the Chinese method of diagnosis by the pulse, and literature on the subject, see Wong and Wu, *op. cit.* 57-66. O. C. Gruner, *A Treatise on the Canon of Medicine of Avicenna* (London 1930) 283-322, gives additional information with a very interesting comparison of Chinese and Arabic sphygmology. Cf. Fr. Hübotter, *Die chinesische Medizin* (Leipzig 1929) 157-193, 198-210. Hartmann, in his "Chinesische Heilmethoden" (*Münch. med. Woch.* June 3, 1927), praises the accuracy of this type of diagnosis by the Chinese in a manner very similar to that of the thirteenth-century traveler William of Rubruck, who has left us the earliest western impression of Chinese medicine.

[13] These were fossils or bones of ancient origin which were believed to have marvelous curative powers and were for this reason commonly used by Chinese druggists in prescriptions. See B. E. Read, "The Dragon in Chinese Medicine," *Jour. North China Branch Roy. Asiatic Soc.* 70 (1939) 21-29; "Animal Preparations Used in Chinese Medicine," *T'ien Hsia Monthly* 8 (1939) 128-44; and R. C. Rudolph, "Early Chinese References to Fossil Fish," *Isis* 36 (1946) 155.

taro, fruit, and oranges. He was impressed with the oranges in Hangchow: "Outside the window there are several dwarf orange trees. The fruit is so plentiful that the burdened boughs seem about to break. If they were in my home they would not be like that!" Tea is mentioned almost daily and liquor, probably wine, just as frequently. There seems to have been a great amount of social drinking, especially on such occasions as leave-takings and arrivals, and on a number of occasions Kuo admits that he became drunk.[14]

Although Kuo complains of tiredness, the hardships of canal travel in winter, and mentions an unexplained trip to the doctor, he does not once say that he himself suffered from illness. It may be argued that self-respect or modesty precluded any direct reference to his own illnesses. But this argument cannot be regarded as conclusive for Kuo was not overburdened with either of these characteristics. He does not hesitate to complain about the cold, he records in tiresome detail his too avid attempts to ingratiate himself with those who could give him an official position, and he almost wails aloud over his tired and aching feet that once prevented him from completing a hike. Any semblance of modesty vanishes in his praise of his own paintings and calligraphy, and in the lists he kept of people who sought samples of his work. It is therefore quite probable that he did not suffer any real illness during the fourteen months covered by his diary. It is also interesting to note that although Kuo recognized and to a certain extent practiced the common religions of China, he apparently had more faith in the methods of the medical men than in those of the priests who were widely resorted to during illness for exorcisms and other means of effecting cures.

If we can rely upon the above notices in Kuo Pi's carefully kept diary as criteria for the state of public health and medicine in China at that time, then we may assume that the educated or upper class Chinese of the fourteenth century, at least those of the same social stratum as Kuo, did not excessively suffer from disease, nor did they to any great extent depend upon thaumaturgy in medical matters.

[14] A sort of thirteenth-century Baedeker's Guide to Hangchow, *Wu lin chiu shih*, gives a list (ch. 6) of the wines (the generic term, which indicates intoxicating liquor in general whether distilled or fermented, is used) sold in and around that city. The names of 54 kinds are given, beginning with "Dew of Roses" and ending with "Overpowering Tea."

Energy Metabolism in Health and Disease

A. MAGNUS-LEVY

I. The Beginnings, the Apparatus

LAVOISIER was the first to approach the problem of metabolism from the quantitative point of view. Together with Séguin he measured the O_2 consumption and CO_2 production of man as influenced by work, temperature, starvation, or food. With Laplace he constructed an ice calorimeter, determined the heat output of a guinea pig, and compared it with the results as calculated from the gaseous exchange in a previous experiment.

The paths of their great masters were eagerly followed by the French in the first half of the nineteenth century. In the 1820's, the Academy offered a prize for the best paper on the heat production of animals. In competing for this prize, both Dulong and Despretz used deficient basic figures, and were therefore wrong in asserting that combustion was not sufficient to supply the energy of heat output. Later Reignault and Reiset improved the methods of determination.

The early history of basal metabolism is largely that of methods and of apparatus. The determination of the gases was done by using either closed systems (glass containers, boxes, chambers) or by ventilated open systems. With the first method O_2 consumption was determined by analysis, with the second it had to be calculated. Calorimetric aparatus could be combined with either system.

Closed circuit apparatus. CO_2 was absorbed by potassium or barium hydroxide, the O_2 consumed being replaced by supplying measured amounts. Such apparatuses were constructed early by Dulong and Despretz, by Reignault and Reiset (1849), by Hoppe-Seyler (1894), and by Atwater, Rosa and Benedict (1905).

Ventilated open apparatus. The first machine of this type adapted for men was constructed on Voit's request by Pettenkofer in 1868. Its efficiency and accuracy proved to be excellent as shown by checks on

alcohol combustion, and Liebig, in his *Annals,* at once called it to the attention of interested persons. In the 'eighties this apparatus was combined by Max Rubner with a calorimeter for animals, the first reliable system of this kind. The same principles were underlying the apparatus of Richet, of Atwater and Benedict (1892), and others. By reducing the space of Pettenkofer's chamber Jacquet as well as Grafe (in 1903 and 1910) gave the O_2 analysis of this system an accuracy that proved satisfactory for many purposes of the clinic, where the systems must be cheap and easy to handle. Tigerstedt and Sonden, enlarging Pettenkofer's chamber to a room of 100 m^3, examined the respiration of a great number of individuals instead of single ones.

In addition to these methods, there was the more simple one of collecting and analyzing the expired air, separated from the inspired by means of valves. For this purpose Lavoisier had put a copper helmet over the head of Séguin; and Zuntz had used a rubber mouthpiece and a nose-clamp which later was replaced by a mouth-nose mask. Animals breathed through tracheal canulas.

All these systems, closed and open, were improved over the years and adapted to various purposes, including the examination of children, cattle, giant turtles, and snakes. Transportable apparatuses for men and animals and micro-apparatus for small objects were devised. Krogh succeeded in examining the respirations of insect eggs weighing no more than 2 mgs. Developing Barcroft's method, O. Warburg created a technique which made it possible to examine continuously the respiration of thin tissue slices in connection with many metabolic problems.

II. The Munich and Berlin Schools

Pettenkofer and Voit had long examined the gaseous exchange in connection with the metabolism of the solid compounds, in starvation and nutrition, at rest and at work (1866-1873). They also performed the first experiments on patients, leukemics and diabetics. For many years science had to rely exclusively on these scanty investigations in disease.

Rubner broadened and extended Voit's work by stressing and putting into the foreground the energetic point of view. That conception seemed to have guided him from the very beginning of his career; he did not emphasize it at first, because his teacher was firmly opposed to it. Voit had definitely repudiated any such conception in his textbook (1881). The law of surface, the isodynamics of the foodstuffs, and the proof of

the energy preservation in the process of life were the great accomplishments of Rubner's life.

The law of surface. In the forties Bergmann, a zoologist, had pointed to the dependency of heat output upon the surface of animals. In physics a strict relationship had been recognized and early acknowledged. Finally Rubner gave experimental proof of its validity in the world of the living organisms by using dogs weighing from 3 to 30 kg.

Isodynamics of foodstuffs. The caloric values of foodstuffs had already been established by chemists. Rubner also determined the caloric value of urine and feces, and by direct calorimetry arrived at isodynamic figures for foodstuffs widely different from those Voit had derived from purely metabolic investigations.

The law of the preservation of energy had been so firmly established and universally recognized since the days of Robert Mayer, Joule, and Helmholtz that its validity in life could not be and never was doubted. But it remained for Rubner to give conclusive evidence of it through experiments. So firmly was Rubner convinced in advance of the positive result of his experiments that he considered them to be a confirmation of the accuracy of his calorimetric figures and methods rather than a proof of the principle.

Because of its evident advantages the caloric unity in metabolism was accepted quickly and applied universally. It cannot be denied, however, that for a long time the one-sided energetical conception overshadowed the conception dealing with metabolism of matter. This was especially true in the case of practical nutrition in health and in disease.

The law of surface was enunciated in a rather dogmatic way, by Rubner, and it met with objections of principle by a number of investigators (Hoesslin, O. Kestner, Kassowitz, Pfaundler, L. B. Mendel). It did not matter much that the "law" gave no evidence of the biomechanics by which it was effected and regulated. Similar lack of causal relationship is found in phenomena of life without, however, invalidating statements of facts.

Rubner had used Meeh's formula $s=3\sqrt{w2}$ derived from actual measurements of surface area. E. F. and D. Dubois in their original publication gave a graph for the height-weight formula which is used about as extensively as Boothby's nomogram. Many others have made similar nomograms. One resembled Pfaundler's "linear formula" published almost simultaneously, and the other a "height-weight" formula expressed

in a graph, later made more convenient by Boothby's nomogram. Benedict on the other hand, never acknowledged the validity of the surface law. Leaving aside any consideration of the surface area, he took into account weight, height, and age, only. By simply measuring these three factors in experiments of his own on 239 normal individuals he drew up, together with Harris, tables of normal basal metabolism covering every permutation of those three factors.

Rubner had not taken into acount the influence of sex and age. This was done in the 'nineties by Tigerstedt and Sondén and by Magnus-Levy and Falk. Energy output, in the female, was found 10% less then in the male; with children it was considerably higher than in adults. In adults it remains on the same level for many decades until it finally decreases 10%-15% in advanced age. Figures of the same individual at 26 and 76 years have been published. During the first months of life basal metabolism shows no steady course (Rubner, Heubner, and others). In this period the previously well protected baby has to adapt itself to the conditions of the outside world. An increase of energy production in the prepubertal period asserted by some authors has not been proved definitely.

In addition to the work of Voit's department there was that of the Zuntz school. Voit's and Rubner's experiments were devoted mostly to nutritional balance and to the changes of the body constituents. The work of Zuntz dealt with the single components of energy and gaseous metabolism, its partition into its parts as influenced by and influencing the activities of the organs, especially the heart, lungs, and the blood, and their interdependence. Also the influence of the "milieu," the conditions of the outside world were examined carefully. In this field valuable work had been performed earlier. The name of Paul Bert, the French scholar, must not be forgotten. Speck, one of the many German country practitioners who by simple methods and with no contact with research centers early contributed to the progress of science, also deserves to be mentioned.

Zuntz adapted the methods to his aims. The Zuntz-Geppert apparatus permitted the analysis of both O_2 and CO_2 and their continuous examination by a sequence of short, timed experiments. (It was also the first transportable apparatus, thus fitted for application at the bedside on a large scale). Voit did not show much interest in experiments of this kind, and Rubner mostly ignored them. Later on, when as a hygienist he turned to experiments of short duration himself, he belittled or even

deprecated Zuntz's experiments. There has been a rather sharp controversy between the two German schools. Later, however, when a pupil of Zuntz in his textbook on physiological metabolism pointed out the differences of spheres and the significance of the two methods, the great old man of Munich did not hesitate to give his approval by a kind letter.

Zuntz's main interest was devoted to the examination of muscular work. The experiments, frequently concerned with practical purposes, consisted in walking and running (of men, horses, or dogs) on level or inclined ground, with load or without, mountain climbing, swimming, cycling, and so on. For example, on an inclined tread mill, with a horse trotting, the work of the heart was measured by simultaneously taking samples of blood from the arteries and the right heart, and also of the expired air.[1] The calculations made from these samples were compared finally with the mechanical work of the animal (1893). The efficiency of the total energy expenditure in climbing was calculated by Zuntz to be 33%; the quotient would be even higher if only those muscles were taken into account which actually effected the raising of the body.

With different work, however, Swiss, Scandinavian, and American physiologists reported lower values. In any case the efficiency of the animal mechanics would have surpassed that of men's engines. In the long run, however, the conception of the muscle as a caloric engine had to give way to the modern one by which the muscle is considered a straight chemical engine.

The significance and the importance of the CO_2: O_2 quotient (Pflueger gave it the name "respiratory quotient") was recognized early and on the whole interpreted rightly. It was used as a means to calculate the varying participation of the three main foodstuffs in combustion. Zuntz calculated the caloric equivalent of O_2 pertinent to the various values of the RQ. Thus it played an extensive role in the interpretation of metabolism. It must be admitted, however, that when oxidation was incomplete, interpretation and conclusions not infrequently lacked obvious evidence. Thus Zuntz had concluded that on a mixed diet muscular energy was not derived from sugar or fat exclusively, but from that casual mixture which had been burned in the preceding period of rest.

[1] The difficulty of such experiments, requiring the greatest skill and accuracy, must be remembered. The analyses were performed by the methods of Bunsen and Ludwig in a large room reserved exclusively for gas analyses. The arrangements for that work and the analysis of any single sample took many hours and even days.

The RQ in work did not rise materially when it had been low, nor did it decrease much when it had been high in rest. Zuntz at first did not find any difference between the utilization of fat and sugar energy in muscular work. Thus he concluded that if fats had to undergo previous conversion into sugar, as had been assumed by various authors, the whole of that conversion had to take place in the muscle itself and without any loss of energy. Zuntz's conception was not confirmed by the physiologists of the following generation, Krogh, Cathcart, Benedict, and others, who definitely demonstrated that utilization of fats in work was inferior to that of sugar by about 11%.

Though some of Zuntz's principal theories were eventually refuted, credit must be given him for having first investigated the physiology of respiration and of muscular work from all points of view.

In competition with Mosso, Zuntz was also the first to investigate the physiology of climbing in the Alps. Their work was extended by English and American climbers. This research was the precursor of aviation physiology, the importance of which is now overshadowing most of the other problems.

The concept "basal metabolism" has acquired honorable citizenship in the science of metabolism. Naturally the author who originated the term was pleased by this recognition but he did not believe that anything essentially new had been introduced except for the name. It was his intention, and it was fully realized, to establish a reliable basis for an elementary function, by which the varying conditions in a single individual and the behavior of different individuals could be compared and scrutinized. Up to that time no satisfactory method of comparison had been developed. The gaseous exchange, to be sure, had already been examined with empty stomach and with a certain state of rest, either "room rest" in the respiration chamber without definite work, or the relaxing rest of sitting on a chair, or a restoring rest while lying on a couch. Instead of these variable factors definite limitations were prescribed, a fasting condition of the *entire* digestive tract in the early morning; "a deliberate rest of the muscles was postulated with conscious muscle relaxation and avoidance of every motion." At the same time, Johannson stressed the same requirements. Thus the name "Grundumsatz" was chosen in consultation with Zuntz, the term meaning "metabolism required for the conservation of normal functions while the organ activity is eliminated as much as possible." After some initial vacillation,

Lusk and Dubois translated "Grundumsatz" into "basal metabolism" and helped to secure its general recognition.

Several arguments have been brought up against the concept of basal metabolism. It was unimportant that working muscles, those involved in breathing and the heart, had a share in basal metabolism. Their work, of course, is needed for the maintenance of normal functions. Then it was urged that basal metabolism is not a "minimum metabolism," since it declines during deep sleep. In fact, however, it does so only by a small percentage. That slight difference comes into account only for the calculation of the 24-hour value of basal metabolism. In practice, however, one unfortunately deals with fluctuations of 10%. But for these purposes the human being is not a good testing object; this elementary function is much more constant in some animals. Graham Lusk has reported that "the maximum variations did not exceed 2.9% within a period of 15 months in a well-trained, quiet dog, nourished with the same maintenance diet. In the tests with an alcohol flame it was 1.9%!"

To basal metabolism was opposed "der Leistungszuwachs" the increment caused by any additional work of the organs. It consists particularly of the energy requirement for the utilization of food and for the activity of the muscles. The magnitude of both was examined by Zuntz in almost all their details. With reference to the "expenses" for food utilization, the conception of Rubner eventually prevailed over that of Zuntz and Mering. The latter had referred that factor to the mechanical and chemical work of the digestive system. According to Rubner, on the other hand, the increase does not stem from any single system; it cannot be located anywhere at all. On the contrary, it was a "dynamic" reaction, different and "specific" for each of the three main food-stuffs. It was smallest with fat, somewhat higher with carbohydrates, very distinct, however, with protein. During an abundant meat diet Rubner found an increase in metabolism of 42%-46% within 24 hours. In the successive hourly experiment of Zuntz's laboratory the maximum amounted to 90%. With a permanent excess of meat diet, the basal metabolism, too, increased considerably for the duration. Rubner has referred that increase to "a secondary specific dynamic action." E. Grafe has discussed that increment thoroughly from the viewpoint of the luxury consumption. Graham Lusk when trying to analyze the action of protein, found a distinct effect with single amino acids, e.g. with glycine and alanine, but with some higher amino acids it was absent.

III. STARVATION, UNDER- AND OVER-NUTRITION

Experiments with animals kept fasting for short or long periods were started at an early period because of the simple conditions and the easy interpretations of the results. The first reliable figures for the total and the protein metabolism were obtained in this manner (Bidder and Schmidt 1852, Bischoff and Voit 1860). Soon the detailed study of the gaseous exchange was added. That domain became particularly attractive when professional starvers ("Hungerkuenstler") volunteered for long-lasting experiments. Poor Italians occasionally earned their bread through fasting. The first circumspect and many-sided ten-day observation was made by Zuntz and his associates in 1893. Luciani worked on the problem at the same time, and others followed them. The cardinal question was whether an adaptation occurred in hunger, a saving of substance and energy over and above the actual loss in living cell substance. It was not evident within the 6th and 10th day of Zuntz's experiment nor those of subsequent investigations. Later America, Germany, France, and Japan each contributed a series of 22-35 starvation days. In one of these series, for example, with a loss of 13 kg. the absolute heat output declined from 1432 to 1072 cal., while the loss per square meter was more than 30%, and that per kilogram weight 19%. In animals the same thing was observed, contrary to Rubner's original assertion that energy consumption decreased only in proportion to the loss of weight and living protoplasm.

Such saving of energy had already been found in the 'nineties in chronic malnutrition, at first in patients whose illness had led to extensive emaciation. If the disease was a curable one, and if the patients had reached approximately their original weight, their normal metabolism could be examined and compared with the previous low figures. In those conditions, too, differences of 30% and more were observed. Such experiments were performed by Magnus-Levy, A. Loewy, Svenson, and others.

Finally Benedict has carried out experiments with two healthy athletic groups of students. By cutting the intake in half (to 1375 cal.) and with a weight loss of only 4.5 kg., the absolute metabolism decreased within 3 weeks from 1745 to 1293 cal. (26%). There was a loss of 20% per kilo and 27% per square meter.

With overfeeding, too, an adaptation takes place, but, of course, in the reverse sense, with the energy output increasing. It has been discussed as meaning a "luxury consumption," a term which in the course of time

has been applied in different senses. The word luxury, when thought of as a squandering, has meaning only in the terminology of political, but not biological economy. In dogs, overfeeding with protein (with or without excess of other fuels) leads to an increase both in basal and in total metabolism. Thus, the animal not only gets rid of a major part of the superfluous protein, but also of a certain part of the excess of the energy intake. The question then arose concerning the extent of the same phenomenon in men, where overabundant supply consists of the three great foodstuffs. Every scientist interested in the question of obesity has had to deal with that problem. Only few experiments gave clearcut results. E. Grafe again has treated this question in a very precise way. He carried out two experiments by overfeeding 100 cal. p. kg. over a period of many weeks. The heat output per square meter increased to 40% and to 20%. American authors, however, did not confirm this observation.

IV. Energy Metabolism in Disease

Until 1890, several excursions into the field of pathological gaseous exchange had already been undertaken by Pettenkofer and Voit. The apparatus of Zuntz-Geppert opened the clinics to this research. Magnus-Levy had aimed at surveying the entire field. Nothing good was to be expected from Bouchard's rather vague assertion of a "rallentissement de la nutrition"; in fact, it remained doubtful whether retardation meant a reduction, as a whole, of the metabolism, or only a temporary postponement with overlapping of the single phases. With his work, which resembled the work of a prospector in a little explored mountain, Magnus-Levy had the good fortune to discover the cardinal role of the thyroid gland. He pointed also to some smaller veins, the pursuit of which proved to be worth while.

The clinical significance of the thyroid had been recognized in the 'seventies in myxedema by men like Gull, Ord, Fagge, and Kocher. In retrospect it is remarkable that it was ignored in the more striking and more frequent Graves' or Basedow's disease. Even the investigation of the gaseous exchange did not start from the diseases of the thyroid gland (although Fr. Müller's publication on Basedow's disease (1892) could have pointed to it), but rather from obesity. Because of weight losses in myxedematous patients Leichtenstern, simultaneously with an English physician, had given thyroid tablets to obese patients, and had observed

a marked decrease of the panniculus adiposus. No doubt a direct therapeutic influence upon the combustion had thus been observed for the first time. The first determination of the gaseous exchange in an obese nurse performed by Magnus-Levy (1895) showed an increase in oxygen consumption of 30% after giving 1 to 3 thyroid tablets daily for three weeks. Thereby the task was set, and solved step by step: In Basedow's disease increases of 50% and more were observed, and in acute cases even up to 80-100%. In severe myxedema a decrease of metabolism to half of its normal extend was found; within a month, after thyroid ingestion, it rose to normal figures. After discontinuing that treatment for 4 to 8 weeks, with full recurrence of the former myxedema status, basal metabolism reached the low initial figures. Repetition and comparison of different extracts and drugs in the same individual were thereby made possible. Thus four steep and absolute similar curves were obtained within two years in 167 single determinations in the same patient. The entire investigation included 35 patients representing all conditions and degrees of thyroid involvement. Twenty-five years later, Boothby and Sandiford reported from the Mayo Clinic 1689 cases of thyroid within one single year in comparison with 1642 other patients. Thus, statistics, statements, predictions, and applications for single patients became possible. Potassium iodate, hypophysis tabloid, or thyreo-antitoxin proved without effect.

Owing to the authority of Charcot, Basedow's disease was generally considered to be a disease of the nervous system. It was as late as the 'eighties that Moebius, who was also a neurologist, proclaimed that disease as the counterpart of myxedema. The contrasting behavior of the gaseous exchange in the two diseases was a welcome confirmation of Moebius' assertion. Ever since, the conception of hyperfunction and hypofunction has played an important role in the study of many organs.

When the amazing "organotherapy per os" was found in myxedema, a wild hunt began for similar easy successes in diseases of other organs! Patients suffering from kidney diseases were indiscriminately given raw kidney, patients suffering from liver diseases were fed liver, anemic patients and patients suffering from spleen diseases were given spleen, and so on. Then, a sarcastic German clinician could say bitingly: "Headaches are being treated nowadays by giving ground head to the patient!"

Similar distinct and easily interpretable deviations as seen with the thyroid had at first not been observed with other endocrine glands. In

order to ascertain them, the extensive material of the Mayo and other clinics (Boothby and Sandiford) or of individual clinicians was required. Cushing found an increase in metabolism up to 61% in 2/3 of his 72 acromegalic patients, and a decrease (down to minus 36%) in 2/3 of 107 cases of hypopituarism histologically confirmed. A cooperation of the thyroid may be involved therein.

Concerning the adrenals, the destruction of the medulla and cortex resulting in a dwindling of all vitality, pointed to serious metabolic disorder. During the last stages of Addison's disease the gaseous exchange always decreases (Aub and associates). A hyperfunction of the cortex or the medulla was scarcely known; the effect of the medulla could only be studied by adrenalin injections.

In diseases of the blood also, the results were not uniform; a distinct increase in energy output has been reported only in severe leukemia. E. Grafe, finding increases up to 100%, referred them to enhanced metabolism of the quickly regenerating leucocytes, the accumulation of which in all organs results in a large total. In the future it would be worth while to determine their total amount in the whole body, and the rate of their destruction in each individual case. A decline in metabolism with anemia, which was expected previously, has not yet been reported. In severe forms, there was rather an increase. The same is true in the case of polycythemia.

In the case of diabetes, Weintraudt was the first to demonstrate normal energy consumption, contrary to the assumption of most clinicians postulating a high food requirement. His statement gave a reliable basis to Naunyn's insistence, empirically arrived at, on moderate food intake. Weintraudt's statement was frequently confirmed; however, in patients with severe diabetes direct and indirect calorimetry often yielded higher figures. Joslin ascribed them to severe acidosis; Gephart, Lusk, Dubois, and Grafe on the other hand to the exaggerated protein intake. When Joslin cut down his patients' liberal diet to Allen's minimum diet, a rapid decrease chopped the energy output from plus 12% to minus 11%. Though ketonuria then vanished also, Grafe's interpretation seems to be the correct one.

The hope of solving the problem of constitutional obesity by direct or indirect calorimetry did not quite materialize[2] by measuring the total

[2] There was the difficulty of calculating the surface of the voluminous obese, since actual determinations thereof had been made only exceptionally. Certainly, surface increases far less than does the weight.

metabolism or that of its single components. Magnus-Levy as well as von Noorden early calculated that the storing of only 10g of fat a day would result in a deposit of 20 kg within 5 years; they insisted that such a small amount as 100 calories could not be recognized by measurement and still less could it be proved due to a saving. As to mechanical work, the obese man, even if not clumsy, can by no means perform the same work with less energy expenditure than does the normal individual. Though a saving of energy during the rest following the work, a "negative phase of work" once was pompously announced, that foolish assertion rightly fell into oblivion. Certainly many obese "patients" are moving and stirring about far less than the non-obese, but their obesity is not at all a constitutional one in the sense of metabolism. As to saving in the expenditure for food utilization, the specific dynamic action often has been found low or even lacking, but the same is also true of normal individuals. Moreover, that saving represents only some percentage of the total metabolism. Thus endogenous obesity could be referred only to a decrease in basal metabolism. But, as Grafe correctly stated, only a decline of more than 15% to 20% could be considered as definite proof. Such a decline, however, has been observed very rarely, according to the critical examination of all available material by the author himself. Only in two cases did Grafe himself find a decrease of 20% to 40%, and amongst 300 reliable experiments scarcely a dozen similar could be found.

Dubois, the author of the comprehensive book on basal metabolism, also holds the opinion that endogenous obesity cannot be explained fully by our present methods. Whether it actually exists in the *single* individual, remains doubtful. Its presence, however, could not be denied as shown by experience with endocrines pathology, especially pituitary obesity. The effect of the "vital" gonads on metabolism is, to be sure, rather doubtful. Menopause obesity is rare, castration obesity in adults does not occur frequently, and if it does, other endocrine glands are probably involved.

Fevers, a crucial problem of pathology, have intensely interested the clinicians. According to Traube, fever is due to a changed ratio between heat production and output. Senator early found a decrease, Leyden and other authors an increase, in CO_2 production.

Liebermeister (1870) accomplished the best early work in scrutinizing and clearly presenting the problem, and taking into account all facts of

metabolism known at that time. He chose malaria as the best febrile disease for his studies. His calorimetric methods differed fundamentally from those generally adopted. He used cooling baths, just then introduced into the treatment of typhoid patients, for direct calorimetry, and examined the different stages of that disease in four continuous half-hour experiments.

There was an increase in CO_2 of 150% during the chills. This figure by far exceeds that found in other fevers. It apparently is produced by involuntary muscular activity and thus with the simultaneous inhibition of heat-output leads to a steep rise of the curve. Liebermeister correctly calculated that each degree of rise in the body's temperature was equivalent to the storage of 50 to 60 calories, an amount corresponding to the hourly heat production in the normal individual. During continuous fever, heat production and output were equal, according to his experiments. Such equilibrium is possible at different temperatures and at different heights of metabolism. The metabolism is "adjusted to higher temperatures." Likkalcheff and Awaroff much later obtained the same results in their great copper respiratory chamber.

Kraus and Loewy (1890) began the determination of oxygen consumption in fevers, and in 1906 direct calorimetry was also applied. For certain questions, the animal experiment was used by Staehelin and others. Instead of typhus exanthematicus and recurrens which had disappeared from Central Europe, cases of typhoid fever, pneumonia, erysipelas and acute articular rheumatism, sepsis, and other infections provided the material for study. During the stormy initial stage of these infections and at their peak, metabolism increases as high as 50% were found; with continued fever, a slow decrease was noted. With adjustment of the calorimetric apparatus to short experiments, the hourly metabolism could be followed. The findings of Liebermeister on malaria were fully confirmed.

There was a general inclination to explain the increase as due to the chemical disorder of the infections. Later on, the height of the body temperature came into the foreground. Dubois was able to show on 137 curves of his own that the temperature coefficient of the body from 37% to 41% was in full agreement with van't Hoff's law. The agreement of the recorded curves with the theory is, in fact, very striking.

In the beginning of convalescence, some days after definite defervescence, Svenson found a short-timed decrease in basal metabolism of 45% to 50% below normal. It was interpreted as an efficient means of saving in emaciated patients after protracted underfeeding.

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Dublin's Contribution to Medicine

WILLIAM DOOLIN*

IN THE YEARS between Waterloo (1815) and Sedan (1870) Dublin may justly claim to have revolutionized the teaching of medicine on two continents. The men who brought this revolution to pass were few in number, but their achievement remains, an imperishable fragment of the vast accomplishment of modern medical progress in its ever-widening influence upon the welfare of humanity at large. In seeking to tell how these men laid the foundations of the Dublin School of Medicine, one must first sketch in, however lightly, a general outline of the city as it was when their century was opening.

At that time, Ireland had a population of a little more than eight million souls, of whom virtually half could neither read nor write. Dublin was then a fast-growing capital city, her inhabitants having increased from 185,000 in 1821 to 203,000 in 1831, and 232,000 in 1841; by 1851 they had passed the quarter-million. Amongst these thousands, the poor were an ever-pressing problem, and the bigger the city grew the more of them there seemed to be. Notwithstanding the ravages of poverty, cholera, and typhus, life then, as always, was stronger than death.

After the passing of the Act of Union (1801), Dublin, though still the capital, was no longer the seat of government; and it was a woeful journey Dublin-wards from London in those days. That journey took more than a week by stage: five or six days from London to Chester, and from there to Holyhead another three through the mountains and ravines of North Wales. Up to the year of Waterloo, the road to Holyhead was the despair of travelers. Once the Menai Bridge had been built, travelers by the Irish Mail could accomplish the 260-mile road journey in 26 or 27 hours, a little less than ten miles an hour in a suffocating box padded with straw, prepared to face another twelve hours of misery in the packet sailing for Dublin port. The landfall made, there were only three

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public vehicles to carry mail at all, and there was not a single road radiating from Dublin on which a coach could exceed four miles an hour with safety to its occupants. They had their transport difficulties then, too, if with a difference.

The railways were slow in coming to Ireland. In *Thom's Official Directory* for 1844 we read:

> Several extensive lines of railroad have been suggested by the Railway Commissioners, but none of them as yet have been carried out. The only complete line in Ireland is that from Dublin to Kingstown, 6½ miles.

Traffic between Dublin and the country districts was carried mainly on two canals, the Royal and the Grand, on which, the official advertisements ran, "incoming coal, sea-borne, pays a duty of fourpence a ton." By then the city streets were lighted by gas, but the electric telegraph and its nosiy offspring, the telephone, were not yet part of the city's amenities.

Much admiration was expressed by English visitors to Georgian Dublin. Sackville and Dame Streets were then the centers of fashion, the latter indeed having been described by one enthusiastic Londoner as "bearing a strong resemblance to Bond Street." In Sackville (now O'Connell) Street had dwelt William Dease, President of the Irish College of Surgeons, who had for neighbors a dozen peers and fourteen members of Parliament, all residing within a stone's throw of the Rotunda. Most English visitors, however, were profoundly shocked by the contrasts between rich and poor in the capital, and few were ever tempted to explore the "narrow, dirty and obscure parts of the town" surrounding the two Cathedrals—these were the Liberties, the state of whose inhabitants had aroused the indignation of Dean Swift. The window tax of William and Mary (1696) was not abolished until 1861; this tyrannous tax on light and air was an activator of infection in the dark, vermin-infested dwellings of the poor all through the century. As for those who dwelt therein, a visiting London actor was heard to observe that "until he had seen the beggars in Dublin he could never imagine what the London beggars did with their cast-off clothes."

Such want and misery found a responsive compassion. An incoming philanthropist in 1846, treading in the footsteps of John Howard, would have been able to inspect no fewer than fifteen of the present city hos-

pitals which today have known a century of service among the sick poor of the city. Of these, eight had been established during the preceding century. These Dublin hospitals deserve a little emphasis here. The great charitable movement which in the eighteenth century led to the establishment of voluntary as distinct from the Royal or State-aided institutions throughout the United Kingdom had its origin in Dublin. The bequest of his estate in 1710 by Dr. Richard Steevens to build a hospital "for such sick and wounded whose wounds are curable" afforded an example speedily followed by Dr. John Addenbrooke (1719) in Cambridge, as it was in London by Thomas Guy, who built his hospital out of the profits which he had made in the South Sea Bubble. But Steevens' was not the first of Dublin's voluntary hospitals. In 1718, six Dublin surgeons had opened a house in Cook Street for the reception of surgical patients of the poorer class; in 1723, under the aegis of the Dublin Corporation, their "house" became the Charitable Infirmary, now known as Jervis St. Hospital. (Not many Dubliners today advert to the fact that this is the oldest of the city's hospitals.) Guy's, the first voluntary hospital in London, was not opened until 1728, in which year the foundations of Mary Mercer's "Stone House" were laid. Steevens' was opened for patients in 1733, and Mercer's in the year following.

Dr. Steevens' stipulation had been that his hospital should be "for the relief and maintenance of curable poor people." His choice of phrase was significant. The general hospitals of the day always excluded "incurables"; here again Dublin led the way, for the first Hospital for Incurables was founded in 1744 in Fleet Street.

In yet another field Dublin had also pointed the way before the century opened, with the foundation of a special hospital for women in childbirth. This, too, had been the idea of a medical man, Dr. Bartholomew Mosse, the bicentenary of whose hospital, the Rotunda, fell in March, 1945. (A special Bicentenary Congress to celebrate the anniversary will be held in Dublin in June, 1947.)

Dublin's earliest contribution to medical progress, therefore, was the idea of the voluntary hospital. Not unnaturally, the character of these institutions was impressed upon them by the men who worked within their walls.

From time immemorial down to near-recent days, those who prac-

tice the healing art have worked in two main divisions: the surgeon, essentially a man of his hands, learned his handicraft largely, and very often literally, "under fire" on the field of battle—even as thousands of them have done in World War II; the physician, on the other hand, studied his texts within the sheltered calm of his university, from which he emerged to practice as the Doctor, the lettered man, whilst his humbler colleague, the craftsman of the medieval guild, had to rest content with the simpler title of "Master"—whence the "Mr." which in England and Ireland today indicates the surgeon's calling. As a Master of his guild, the surgeon was free to take and teach younger men as his apprentices, and to the Dublin hospitals between 1800 and 1870 the surgeons brought their apprenticed pupils; from this privilege, its origins stretching back to medieval days, derives one noteworthy feature of the Dublin teaching system today (and one much envied elsewhere), by which each year so many resident pupils are elected to the Dublin hospital staffs.

Between 1800 and 1815, Dublin students got their professional education as and where they could. The century opened with the passing of the School of Physic Act and its foundation of Sir Patrick Dun's Hospital as Dublin University's medical clinic (1810). The Royal College of Surgeons (Ireland), founded in 1784, had its own school, but it controlled no hospital. Its license qualified its members for entry into the armies mustered by Pitt to grapple with the Corsican dictator. The French wars were largely responsible for the number of "private" schools of medicine in the city. Teaching had become a profitable business, and the student of 1810 or 1815 was no different from his counterpart of today—he went where he believed he would get best value. Throughout the United Kingdom every licencing body made its own laws; in Ireland, no more than in Great Britain, was there any legal restriction on practice or education. The standard everywhere was low. Many a man graduated M.D. without ever having examined a patient.

For those who would have liked a better education, Paris, the leading school in Europe, was cut off by the wars. London, without a university, had no direct influence upon teaching. Edinburgh was then the foremost school in these islands, with a teaching tradition as old as Flodden Field itself. John Cheyne, the first physician to the Meath Hospital, had graduated M.D. there in his eighteenth year. After a riotous career in army service, he settled down in practice in Dublin, where he made fan-

tastic sums of money; then, having "found religion" in his old age, he retired to England to atone for high living in his youth.

Within three years of Waterloo, a tall, dark-complexioned youth of ready wit and sarcastic tongue graduated from the School of Physic in his twenty-first year, having taken every possible prize in his course on the way to his degree. A descendant of one of Cromwell's colonels who, in the polite parlance of Victorian biographers, had "acquired considerable property in the county of Limerick," Robert Graves had been a phenomenal student, and, the family means permitting of a long tour of Continental study, he had enjoyed three postgraduate years spent in visiting the best teachers of Berlin, Göttingen, Vienna, and Copenhagen, with vacation trips to France and Italy. Like other youths with well-lined pockets, he had had his adventures, of which we may select three as exemplifying the character of the man who was to revolutionize the medical teaching of his time. His facility in languages was such that in Austria he was taken for a German spy, and had to submit to ten days' imprisonment before his correct identification could secure his release. Crossing the Alps in a diligence en route for Italy, he shared the journey with Turner, the painter. They traveled together for weeks, sharing the same inns, eating, conversing, and sketching together, neither asking the other's name until it was time to part company. Once, sailing from Genoa to Sicily, their boat ran into a storm. Its sails torn to ribbons, its pumps choked, its crew were about to cast off in a rowboat, prepared to leave their passengers to fate. Graves, though abominably seasick, seized an axe and stove in the sides of the boat, declaring it was a "pity to break up such good company"; then, taking command of the stricken crew, he had the suckers of the pumps removed and, cutting from his own boots the leather necessary, had the valves renewed; the crew returned to their duty, the leak was stopped, and the vessel saved.

Youth, vigor, determination: these are qualities to be found in many an Irishman. When to them is added *ce petit rien de superflu* which has allowed a first-class education to be rounded off with years of travel and experience, the whole fired by the demon which, knowing that something ought to be done, knows also what that something is, and is determined to get it done, the combination becomes irresistible. Graves' opening lecture to his students at the Meath Hospital on his return in 1821 shook the complacency of the Dublin pundits severely. Many lives, he boldly

declared, were lost each year owing to bad treatment by doctors whose teachers had never taught them to practice; students "walking the hospitals" in Dublin made their appearance there as critics rather than as learners, coming to the hospital seeking entertainment rather than instruction; many were annually dubbed doctors who had scarcely ever been called upon to write a prescription—practitioners, these, who had never practiced, whose errors were to grow with the years for want of properly directed clinical instruction in their youth. "Why should we be so infested?" Straight hitting, this, but as timely as it was necessary.

The clinical methods taught in all schools today we owe in large measure to Graves. The hospital lectures given before his time, both in Edinburgh and in Dublin, consisted of Olympian dissertations delivered in indifferent Latin by a lecturer to his class who, notebook in hand, took down and memorized his every word. That artistocratic gulf between teacher and pupil was broken by Graves. The practice of medicine, he declared, could not be learned by hearsay: that was "book-medicine" at its very worst. Taking his class to the bedside, he allotted to each student a patient, every detail of whose course was to be studied and recorded from beginning to end of his stay in the hospital. Graves' *student-practitioner* thus was charged with the immediate responsibility of investigating his cases for himself and by himself, under the personal guidance of the teacher.

To Whitley Stokes, Graves' senior colleague at the Meath, the coming of this remarkably outspoken young man must have been comparable to the sudden blast of a whirlwind down its hitherto peaceful corridors.

For close on a century and a half there has been a Stokes in active service at the Meath. It is a proud family record. Whitley, first of the dynasty, was a cultivated eighteenth-century gentleman whom Wolfe Tone acclaimed as "the very best man he had ever known." Sent down from Trinity on suspicion of being a United Irishman, Whitley survived such undesirable acquaintance to become Regius in the College which had cast him forth. Occupied as he must have been with his duties as hospital physician and Professor of Medicine, he yet contrived to found the Irish Society, had time to translate the New Testament into Gælic, and to leave Dubliners permanently in his debt by his foundation of the "Zoo," enjoyed by all good citizens today. Yet, and in view of our earlier reflections on Irish education in those days the fact is significant, he did

not send his son to Trinity.[1] William—*the* Stokes of medical history—was sent to learn his physic at Edinburgh.

The younger Stokes' youthful abilities were in no way prophetic of the intellectual eminence which he was in later years to attain. Scarcely, indeed, did they even suggest the probability of distinction. His course was starred by no such succession of glittering prizes as had been Graves'. Yet few students have commenced their medical studies on so broad and rich a base of general education. His father's constant companion during the formative years of adolescence, most happily familiar with the best in classical and modern literature, William shared to the full his father's love of natural history. In Edinburgh he was fortunate to find in William Pulteney Alison a clinical teacher whose own love of practical medicine was infectious. Speaking years later of the experimental method in medicine, Pasteur said: "Fortune favors only the prepared mind." William Stokes' was such an *âme préparée.*

A few years before, in Paris, another youth, a Breton, filled with Celtic fire, Réné Laennec, had stumbled on one of the discoveries of the century, making an immortal contribution to medical science. In the three years between 1816 and 1819 Laennec discovered and described practically all the signs of pulmonary disease discernible to the ear. The treatise in which he gave his discovery to the world is one of the classics of medicine. How and when this slender volume came into Stokes' hands we do not know, but before proceeding to his degree at Edinburgh he had already published a short *Introduction to the Use of the Stethoscope,* receiving the sum of £70 for his first fruits in authorship. He returned to Dublin, the son of a man in his own generation famous, the family reputation enhanced by the publication of his book.

Given the Vesalian drive of the one and the conservative calm of the other, collaboration between two such gifted young men on the same hospital staff might have been dangerous. It was a period in which, to use the phrase of Bacon, the thoughts of the practitioner were scarcely raised above the common cure. Stokes, the younger man, was to outlive

[1] Whitley Stokes was a strong-minded adherent of the Dissenting Communion. In a letter addressed to his wife, preserved in the library of the Royal College of Physicians in Ireland, he directs: "I think they [his sons] should be well acquainted with the Latin language, botany and chemistry. An acquaintance also with ancient and modern history will make them to be the judges of the value of the Holy Scriptures and more convinced of their truth. I would not have them sent to school or College, and wd. rather have them very ignorant than that they should purchase knowledge at the price of the corruption of their morals."

Graves by many years, and to describe him in his biography beautifully as "once his teacher, then his colleague, and ever his friend." The relations between both men were admirable in their harmony; they entered the lists together, neither jealous of the other's distinction, each striving to strengthen their joint influence upon the pupils who, year by year, were drawn in increasing numbers to the clinic at the Meath. Graves' great work on fevers had its counterpart in Stokes' researches into the diseases of the chest; together, through English and American students who came to profit by the new teaching, they popularized the use of the stethoscope in Great Britain and the United States. Not that it was spared its detractors. Many regarded it as a useless toy; "a distorting ear-trumpet" was not the worst epithet applied to it. Some even professed to find it harmful in that its use would prevent the accurate estimation of the patient's symptoms. Stokes was accused by some vociferous critics of opening a new region of science "not inferior to Mesmerism and homeopathy." The opposition to this simple instrument of precision was more intense than anyone could conceive today; yet who now recalls the controversy "Clutterbuck *v.* the Sethoscope" which filled the pages of the *Dublin Journal of Medical Science* through 1839?

The role of the teacher at a hospital is a threefold one: his primary duty is to care for the sick poor; that duty, however well performed, does not relieve him from his other responsibilities, the teaching of students and nurses, and the advancement of knowledge. In their joint performance of this triple task at the Meath, Graves and Stokes changed completely the intellectual atmosphere of Dublin medicine, stamping their personalities on the whole development of medical studies in its two schools. In their work they cannot be separated. They had much to do, and they spent themselves unsparingly.

The depression of the post-war years pressed on no section of the community more heavily than on the poor. "The war," we read in a leading ladies' journal for 1835, "has doubled the cost and trebled the difficulty of genteel living." Within a year of Napoleon's abdication, the cost of oatmeal had risen from 10/- per cwt. to 32/9, the price of potatoes had doubled, and the quartern loaf which had cost 8d. rose to 1/9. Genteel living may have had its difficulties for ladies of quality, but for the "masses" compelled to live in Stygian darkness on the verge of starvation,

disease was the inevitable outcome. In the crowded slums behind the Meath, typus fever, endemic as the century opened, broke out in a succession of epidemics: one in 1817-19, another in 1826-27, the third and worst in the tragic year of the Famine, the Black '47. With no such thing as Relief Acts, no Government aid, no Poor Laws in the country, the shortage of beds was appalling. Stokes has left a graphic word-picture of their efforts to cope with the epidemic:

> So widely spread was the epidemic that we were obliged to have additional accommodation for patients provided. Sheds were built, canvas tents were erected, their floors covered with hay, on which the crowds of patients conveyed to the hospital in carts were literally *spilled out*. I have seen as many as ten patients lying on the hay waiting their turn to be attended to. So immense was the number of sufferers that it became impossible to bestow medical care upon them all. . . . Abundance of whey was provided, and on this, without any further treatment, numbers got well through the fever. I doubt not that the mortality amongst those treated after this primitive fashion was not greater than that among the patients submitted to medical treatment *secundum artem*.[2]

Stokes' comparative bill of mortality echoed that of the "industrious Quaker," Dr. Rutty, who a century beforehand in Dublin had written: "I am assured of seventy of the poorer sort at the same time in this fever, abandoned to the use of whey and God's good providence, who all recovered." The treatment *secundum artem* mentioned by Stokes consisted of repeated bleeding, purging, the use of "sedatives" (a euphemism, this for emetics) and "such a low course of diet as shall coöperate with the other remedies." Graves was as revolutionary in his methods of treatment as in his teaching. Realizing that a starving man was in no shape to resist contagion, he ordered his fever patients to be fed. The results were soon apparent. Taking his class to the convalescent ward to show them "the result of our good feeding," he added: "And, gentlemen, lest when I am gone you may be at a loss for an epitaph for me, I give it to you now in three words: HE FED FEVERS."

Within a very few years their joint reputation as clinical teachers had spread far beyond Dublin. A member of the staff at the Meath has left it on record that in 1833 the class contained so many English students that the native Irish, in Stokes' considered opinion, never worked so hard. John Bassett, Osler's "Alabama Student," brought word back across the Atlantic of things to be learned in Dublin as nowhere else in Europe.

[2] *Lectures on Fevers* (London 1874) 77.

Through the two Stillé brothers, Alfred and Moreton, Dublin's teaching was being followed in Philadelphia within the year.[3] Both through direct contact and the power of the written word, the influence of these two Irish masters of medicine upon American teaching has been profound and lasting. As the apostle of international medicine, no teacher of our day has wielded such influence as William Osler. Addressing the delegates to the Bicentenary of the School of Physic at the Dublin Mansion House in 5th July, 1912, he paid them this tribute:

> I owe my start in the profession to James Bovell, kinsman and devoted pupil of Graves, while my teacher in Montreal, Palmer Howard, lived, moved and had his being in his old masters, Graves and Stokes. . . . The best life of the teacher is in supervising the personal daily contact of patient with student in the ward.

It was a royal tribute from an Oxford Regius. Through Osler, the leaven of their teaching works still in Canadian, American, and English centers of learning.

Many of their individual contributions to the body of scientific knowledge are now of evolutionary, historical interest only. These were years in which men were groping in Egyptian darkness for a glimpse of scientific truth. Till the coming of Pasteur, that light was to be withheld from them. Yet these two names live on, imperishable in our eponymous nomenclature of disease. Even as students today know the Hippocratic facies and the veins of Galen twenty centuries and more after they had been first described, so, too, perhaps in twenty yet to come, students of medicine may in like fashion still speak of Graves' disease and of Cheyne-Stokes' respiration.

The revolutionary changes introduced by Graves and Stokes were opposed by many of the established teachers in Dublin at the time; their obvious advantages, however, were gladly welcomed by the more enlightened. Foremost amongst the latter was Richard Carmichael, a Dublin man who had qualified at the Surgeons' School towards the end of the century and had served for a period of years as an army surgeon before embarking on private practice in the city. As surgeon to the Houses of Industry, better known today as the Richmond Hospital, he was an able and zealous teacher, a man of austere dignity. Three times elected President of his College, he met his death by drowning while crossing

[3] D. Riesman, *Ann. Med. Hist.* 4 (1922) 86.

the sands on horseback at Dollymount, a little way outside the city (1849).

Through the combined efforts of Carmichael, Graves, and Stokes, the Dublin school led in the general movement for reform in medical education. Watching the sorry scramble for practice which in London had called forth the thunder of Thomas Wakley in the *Lancet,* and in Dublin embroiled physician, surgeon, and apothecary in a common loss of all propriety or dignity, Carmichael was an earnest and clear-minded advocate of reform within the body of the profession itself. That reform, he clearly saw, could come only through a stricter educational control. This professional reform, he urged, would necessitate first the separation of the apothecary's art from that of physician and surgeon; this step accomplished, the education of physician and surgeon should be amalgamated and their teaching standardized throughout the Kingdom, with full reciprocity between Great Britain and Ireland. Carmichael's principles, thus clearly enunciated, were, within ten years of his death, embodied in the Medical Act of 1858, with its establishment of a General Medical Council and a Register of Medical Practitioners. "Living, he adorned his profession, and dying was not forgetful of it." In his will he bequeathed a large sum to the Irish College of Surgeons, the annual interest on which he directed should be expended on a Prize for the best essay on the state of the medical profession in the country; the essayist, his quaint direction ran, "will be pleased to make such suggestions as may occur to him respecting the improvement of the profession with a view to rendering it more useful to the public." It had been long since the echo of Hippocrates had been heard in the land: "Where there is love of the art there is love of humanity." In any reckoning of Dublin's contribution to medical progress, the name of Richard Carmichael holds a place of honor.

In the year Carmichael died, Graves had been elected a Fellow of the Royal Society, the highest recognition of ability which British science has to bestow. He was then in retirement, and the distinction came as a fitting crown to a life consumed in the application of scientific method to clinical medicine. Four years later he died, too soon; he was only in his 56th year.

While he lived, Graves was undoubtedly the leader, as observer, teacher, reformer. The fruits of his vision are with us yet. He was a

founder of the *Dublin Journal of Medical Science* (1835) which, under the joint editorship of Kane, Stokes, and himself, must be regarded as a "child of Meath." From the Dublin Pathological Society, founded in 1838, with Graves as its first President, has sprung the Royal Academy of Medicine in Ireland. Hogan's bust, outside the doors of the Academy's library, portrays the features of this demonic searcher after truth; there we can see force, intellect, abundant energy, but there was another side, which no marble can portray. It cannot reproduce for us the voice to which Wilde paid glowing tribute, nor the warm-hearted sensitive nature of the man who, in an age of snobs, never forgot a kindness, nor a friend, however lowly.

After Graves' death the mantle of leadership naturally fell on Stokes. This he was to carry for the next twenty-five years. On the foundation of the General Medical Council he was the obvious choice as representative of Dublin University, helping to bring to fruition so many of the reforms which had been urged by Carmichael and Graves. He had succeeded his father as Regius, and his influence radiated widely as that of a progressive social force, powerful for the public good. He carried on the work of Graves, and gave to physical diagnosis its place in clinical medicine; this he did through direct contact with other teachers in Europe, and through his two great books, both of them classics in medical literature. But his most far-reaching accomplishment was yet to come.

As individuals, the public are fully conscious of the doctor's influence on their personal ailments; but, even in this age of pitiless publicity, they scarcely realize the extent to which the doctor enters today into the collective life of the community. Not in the lifetime of anyone in this generation have Dubliners known a recurrence of the epidemic scourges of typhus, cholera, and smallpox which their fathers had known only too sadly and too well. To the province of preventive, as distinct from curative, medicine Stokes in his years of authority now turned his powerful influence. England's two great ports, London and Liverpool, had had their Medical Officers of Health since 1848. Dublin's Sanitary Commission sat during 1863-64. As President of the Meeting of the British Medical Association which took place in Dublin in 1867, Stokes used all his authority in urging the State's responsibility for the health of its citizens, and in 1870 Dublin University established a special Diploma in State Medicine, the first of its kind in the United Kingdom. Five years

later Cambridge and Edinburgh followed Dublin's example. The triumphs of State Medicine have since been written large in modern history. Thus in public health, as in the idea of the voluntary hospital, Dublin again had shown the way.

Full of years and honors, the leading physician of his time in Europe, antiquarian, naturalist, and lover of *belles lettres* in his leisure hours, William Stokes passed to his rest in 1878. His statue, by Foley, adorns the great hall of the College of Physicians, a figure of great serenity, grave, almost stern of feature, for all its calm, full of power.

One more name from Dublin's physicians yet remains to be mentioned, a minor brilliance beside that of Graves or Stokes, but none the less a star in his own right. In 1832 Dominic Corrigan, in his 30th year, described so accurately a particular lesion of the heart and the characteristic pulse which accompanied it that it bears his name to this day. Despite the historic fact that almost a century and a half earlier both the state of the heart and the changed pulse had been observed by a Frenchman, Vieussens, of Montpellier, so vivid was the Irishman's description that the affection was known as *la maladie de Corrigan* in the French schools, where, years later, Corrigan had the pleasant experience in Paris of being asked by French colleagues if he was any relation to himself. Like Stokes, he was a Dublin man who had received his degree from Edinburgh. Born on the fringe of the Dublin Liberties, son of a small shopkeeper, he died a baronet, having been five times President of the College of Physicians, where his memory is perpetuated by the stained glass window behind the President's chair.

Did these men ever make mistakes? Of course they did. Their errors were for later generations to discover, and, clearing them away, to disclose the solid foundations on which men may continue to build. For in science as in government each generation builds on the shoulders of the generation that has gone before. *Non omnis moriar,* cried the poet of ancient Rome. Nothing of value is ever really lost. They were groping in the dark. The face of disease they knew, by which it could be recognized; but of its causation they were wholly ignorant. Graves "knew fevers," but was in error in regarding fever as a disease entity in itself. He revolutionized its treatment, and sensed that it was due to a *contagium;* he had no knowledge of bacteriology—(how could he have?) —and even fell into dangerous prophecy. While it is true scientific

humility to say "we do not know," it is bordering on the reckless to say "we shall never know." Within a little while, men who had been his pupils were to be led out of the Egyptian darkness, in which he and they had worked, by Pasteur, "after whom all was light." The two greatest discoveries of the century in medicine came from a France resurgent after defeat. Let us remember that today as she rises yet once again from her third agony within a century. With Pasteur's discovery, applied by Lister to the treatment of wounds, modern experimental medicine, which is surgery, began. The years of development after 1870 belong to the new era of scientific medicine.

The story of the Dublin surgeons of the Golden Age of Irish Medicine is yet to be written; they were fine anatomists all, and as expert surgeons as were to be found in their day in Europe. But little of pre-Listerian surgery could be lasting save the anatomical, and, of them all, only one has made any permanent contribution to our teaching today.

As the Meath was to medicine, Steevens' hospital was to Dublin surgery. A Steevens' man, Samuel Croker-King, had been the first President of the Irish College of Surgeons on its foundation in 1784. His successor, John Whiteway, who opened the skull of his kinsman, the gloomy Dean Swift, at autopsy, was also of that hospital's staff. Here, too, enormous classes followed Abraham Colles, Professor of Surgery at the College of Surgeons.

Born at Kilkenny, in 1733, he was a product of the Surgeon's School (1795), proceeding from there to Edinburgh, where he graduated in 1797. Then to London, *walking* there, the whole 400 miles in eight days, to save coach hire. Before the year was out he was back in Dublin, setting up his plate in Chatham Street. After twelve months of practice, his day-book records the following entry: "Sum total fees recd. from Nov. '97 to Nov. '98, £8.16.7d—apparently a trifling sum, yet not dispiriting." He had lived in Edinburgh on "tenpence for a codfish, which lasted me three days." From such modest beginnings, he was to attain to years in which his income never fell below £5000, and to refuse a baronetcy.

This modest little man, with high, domed forehead and shrewd twinkling eyes, was one of the most daring surgeons in Europe. At a time when anesthesia was unthought of, he did not fear to undertake the ligation of the largest arteries in the body, entering into regions where

all before him had feared to tread—and doing so succesfully. He was a peerless anatomist, and enjoyed an unshakeable calm. No orator, two things drew students to him: his teaching was clear and practical, and he was utterly honest. His observation of his patients at the bedside was close and accurate and he was cautious to a fault in drawing conclusions from them. Like Graves and Stokes, his name, too, is enshrined in our literature: "Colles's Law" and "Colles's Fracture" still figure prominently in English and American textbooks.

In one remaining field of specialism Dublin was to lead as she had done in midwifery—the study of diseases of the eye and ear. Simpson's Hospital had been founded as far back as 1778 "for elderly men afflicted with gout and blindness." During the period we have had under review no fewer than seven hospitals were established devoted to diseases of the eye. Of the men responsible for their foundation, two were outstanding, Arthur Jacob and Sir William Wilde.

From what we know of Jacob, he would appear to have been a cantankerous scholar, argumentative and unsociable to a degree, and, like many a devotee of the midnight oil, sadly given to fits of bad temper on the morrow's morn. He first discovered the layer of rods and cones in the retina—still known as "Jacob's membrane," a structure of paramount importance to the airman of today. Wilde, his more brilliant rival, was a national figure in many fields, as statistician, archeologist, publicist, and in none unwilling to tread on other people's toes. Of him it might have been said as Bichat had written of an equally provocative colleague in Paris: *Apprendre fût son premier besoin, savoir sa première jouissance, dévancer les autres sa première passion. Dévancer les autres* was not the least of Wilde's attributes; the doubtful virtue of humility was not amongst his more conspicuous faults.

Such men, however, were true pathfinders. They were few in number, but the path they opened still leads on. While it is right that we should be modest about our school's achievement in the past, and proper that we take heed for its future accomplishment, even at the risk of a little sinful pride we may today remind ourselves that for one brief period—hardly exceeding the third of a century—the schools of Western Europe and America looked to Dublin for a model. Padua, Montpellier, Leyden, Edinburgh, Paris, each in succession had been the Mecca of Medicine; for a short space of time Dublin, too, was to have her turn

amongst the holy places. That eminence was created by a few men, and knew no continuity; with their passing, her leadership passed to other centers unborn in the years of her flourishing. Yet, although that span was short, it had an influence that endures to the present day.

Men die, but ideas live. Across a century of scientific progress comes back the voice of Graves, speaking in his retirement:

> A short and transitory existence has been allotted to our bodies; individuals die, generations pass away, but the common intellect of mankind fears not the same fate nor shares the same brief mortality.

Philately—A Chapter in the History of Chemistry

HERBERT S. KLICKSTEIN* AND HENRY M. LEICESTER**

THE POSTAGE stamp is a little over a century old, but its life has been very full. Nations have always wanted to acclaim their achievements and their great men. In the stamp they found a most convenient and effective medium. Thus much world history is represented in the philatelic activities of governments. It is not at all surprising to find that royalty has occupied a prominent place from the inception of stamps. Not a crowned head has escaped the gallery of postal portraits. Heroes, presidents, generals, and symbols of national power were long the only ones to appear. This was only to be expected, for they all represented sovereignty or postal authority. Then stamp portraits of artists, poets, musicians, and others were issued, many glorifying the history as well as the industrial, agricultural, social, cultural, and commercial activities of countries. Only in the last decades have men of science appeared within the frame of postage stamps. Their first appearance was due more to their political prestige than to their scientific endeavors; only in more recent years have these representatives of science, particularly chemists, found their place in philately in true recognition of their outstanding work. An examination of postage stamps commemorating chemists reveals a most fascinating chapter in the history of chemistry.

All of the stamps in this study fall into the two most important if not the most prolific, groups of philately—the semipostals and the commemoratives.[1] The former are also known as charities, and, as the name implies, a part of the proceeds from their sale is used for purposes other than postal. A surtax, an additional charge over the postal rate, serves to collect such revenue. Usually, but not in all cases, the money is used for some charity. All of the cost of the commemoratives goes into the postal system.

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[1] Hallgren, *All about Stamps* (New York, Alfred A. Knopf, 1940); *Postage Stamps—a Selective Check-list of Books on Philately in the Library of Congress* (Washington, United States Government Printing Office, 1940).

The first semi-postals were distributed in 1897 for a home for consumptives. This new method of soliciting charity spread very slowly. During World War I others began to appear, but it was not until the fighting was over that many more were printed. Then a tremendous number was issued. Many colonies used overprinted or surcharged stamps of the mother country to collect surtaxes. Now semi-postals appear by the score every year in campaigns for tuberculosis, cancer, child welfare, feeding the poor, and many other causes only remotely related to charity. With the end of World War II a new flood of semi-postals is coming out, far greater than before. The important exceptions are Great Britain and the United States which do not use semi-postal stamps.

Commemoratives have been run off in still larger numbers. Originally they were intended to honor only great personages and important historical occasions. They first appeared in 1888 and soon some twenty-two countries had issued them. In the succeeding years, more and more commemoratives came off the presses of the world until today they number almost a hundred thousand varieties. Of these, more than sixty percent have been issued in the last twenty-five years.

Only a little over a hundred men of science and medicine have been honored in this vast number of semi-postals and commemoratives, and these only in the last few decades. About a score of chemists and physicists who contributed heavily to chemistry have had their portraits chosen to decorate postal issues. Although the number is small, one can get almost a panoramic view of chemical history by a review of the names and accomplishments of these personages — Sylvius, Helmont, Boerhaave, Leeuwenhoek, Guericke, Ampère, Volta, Galvani, Lomonosov, Scheele, Lavoisier, Berzelius, Daguerre, Pasteur, Berthelot, Roentgen, Becquerel, Marie and Pierre Curie, Lorenz, Mendeleev, Eliot. Twenty-three nations. the greater number in continental Europe, have contributed to the whole. It is surprising to find France, Russia, and the Netherlands far ahead in the number of chemists honored, while the United States has little to offer, and Great Britain nothing at all. Psychologists might try to find a direct relationship between the appearance of stamps and the cultural tone of the people. A still more interesting phase appears when the political and social aspects of the government are studied, for the interlocking of political and scientific events has a marked effect on the resultant cultural expressions. This will be more fully discussed as the individual countries are examined.

Bugge[2] and Urdang[3] have made use of chemist stamp commemoratives in their respective studies as a mode of illustration, but with the exception of the papers of Weiss[4] and of Schaeffer[5] little has appeared on this phase of chemical history. Weiss has stressed the contributions of physicians while Schaeffer has tried to show that it is possible to pick a series of stamps which can be used to stimulate an interest in chemistry because of the wide appeal of philately. The work of the Clarks[6] has been most valuable in locating many otherwise forgotten issues.

"They needed only a moment to take off his head and more than a hundred years perhaps will elapse before another one like it will be produced," wrote Lagrange when the head of Antoine Laurent Lavoisier[7] rolled off the guillotine block on May 8, 1794. This head has been reproduced on one of the most recent stamps from France. Issued to commemorate the two hundredth anniversary of the birth of Lavoisier, August 26, 1746, it appeared during the German occupation of France. It is an engraved 4 fr. ultramarine blue stamp*[8] with a full portrait head of Lavoisier after the work of David. Postal issue was made in 1943.

Lavoisier obtained his first knowledge of chemistry from G. F. Rouelle (1703-1770) who inspired him to devote himself to this science. He had already studied law, following the profession of his father, but he soon found more interest in chemical work. His brilliant mind brought him fame at an early age. Lavoisier explained the true nature of combustion and threw into oblivion the then universal phlogiston theory. His law of the conservation of matter, and the principle that the names of chemical compounds should indicate their composition were milestones in the development of chemistry and chemical nomenclature. Browne[9] has summarized the work of Lavoisier in a simple paragraph:

> He brought into chemistry a new doctrine, a new nomenclature, a new outlook, and a new spirit. His reforms in the various branches of inorganic, organic, physiological, and agricultural chemistry mark the commencement of the modern era.

When twenty-eight, Lavoisier married Marie Anne-Pierrette, the

[2] G. Bugge, *Das Buch der grossen Chemiker*, 2 vol. (Berlin 1929-31).

[3] G. Urdang. *Pictorial Life of Carl-Wilhelm Scheele* (Wisconsin, American Institute of the History of Pharmacy, 1942).

[4] F. A. Weiss, *Merck Report* 49 (1940) 4.

[5] H. F. Schaeffer, *Jour. Chem. Ed.* 11 (1934) 259.

[6] H. M. Clark and T. M. Clark, eds., *Scott's Standard Postage Stamp Catalogue*, 2 vol. (New York, Scott Publications, Inc., 1946); *Axis Issues of Europe and the Philippines 1941-45* (New York, Scott Publications Inc., 1946).

[7] D. McKie, *Antoine Lavoisier the Father of Modern Chemistry* (Philadelphia, J. B. Lippincott Co., [1935]).

[8] All asterisked stamps appear as illustrations.

[9] C. A. Browne, *A Source Book of Agricultural Chemistry* (Waltham, Mass., Chronica Botanica Co., 1944).

fourteen-year-old daughter of Pouelze, one of his colleagues. She threw herself into his work and with her many abilities, soon became his active assistant. David [10] painted Marie and Lavoisier in 1788.[11] David clearly emphasizes their partnership in the large, full length oil showing Antoine seated at his writing desk, surrounded by his chemical ware, his wife looking over his shoulder as he writes. The portrait on the recent French stamp is taken from this work. Mme. Lavoisier also took painting lessons from David who admired her work. She illustrated her husband's classic *Traité Elementaire de Chimie* (Paris 1789) with fifteen folding plates; the book was the starting point of modern chemistry. Eleven years after the death of her husband at the hands of the revolutionists, Mme. married Count Rumford[12] who she doubtless hoped would recall the happiness of her young womanhood. Unfortunately, he never came up to Lavoisier and the marriage was a complete failure. Her loyalty to Lavoisier was shown by her insistence on being called Madame Lavoisier de Rumford. This was even inserted as a clause in the marriage contract.

Twice France has honored Louis Pasteur with a postage stamp, first in 1923 to celebrate the hundredth anniversary of his birth, and again in 1936-1938. Born at Dôle on December 27, 1822, he soon moved to Arbois, where most of his youth was spent. After attending primary school he seemed destined to become an artist because of his innate ability. His methodical mind was considered slow, all too often the case with genius. Fortunately, his scientific talents were recognized and he was sent to qualify for the Ecole Normale in Paris. He entered in 1843, beginning one of the most brilliant scientific careers in French history.

His first major study was chemical in nature, an investigation on optical activity in which he observed hemihedral facets on crystals of tartaric acid and tartrates, but not on racemates. This work later resulted in the isolation by crystallization of an optically inactive compound, sodium ammonium racemate. This and his other work on tartrates was the beginning of stereochemistry. Shortly afterwards he went to the University of Lille as an instructor, and there he began a series of studies on fermentation, for he was in the midst of the vinegar producing region

[10] Jacques Louis David is regarded as the founder of the French classical school of painting. He was court painter to Louis XVI and later to Napoleon, and was exiled to Brussels in 1815 because of his work in the Revolution.

[11] The portrait is now in the Rockefeller Institute, New York; it was painted when Lavoisier was forty-five years old and cost 7000 livres. See W. R. Aykroyd, *Three Philosophers* (London, William Heinemann Ltd., 1935); see also H. S. Van Klooster, *Jour. Chem. Ed.* 23 (1946) 210 for details of the bicentenary exhibit.

[12] I. A. Thompson, *Count Rumford of Massachusetts* (New York, Farrar and Rinehart, 1935).

of France. His statement that fermentation is the result of microscopic organisms was startling, and it was years before all sceptics were convinced. However, his experiments finally disproved the theory of spontaneous generation. From these fundamental concepts he proceeded logically into other researches in bacteriology which added much to our knowledge of contagious diseases, viruses, vaccines, hydrophobia—indeed stereochemistry, bacteriology, and immunology stem from his work. The Pasteur Institute was built in his honor by public subscription, and here he worked until his death on September 28, 1895.

The first stamp to portray Pasteur was issued for a period of three years (1923-1926) and depicted a full left profile of Pasteur. It was probably taken from a study made when he was sixty years old. Some ten stamps appeared in the series in all colors, 10c. green*, 30c. red, 50c. blue, etc. Bugge[13] uses this stamp as an illustration in his book. The second stamp was a surtax for the relief of the unemployed intellectuals of France. Two releases, a deep ultra-marine 1.50 fr. plus 50 c. and a blue 1.75 fr. plus 25c.* were issued in 1936 and 1938. The three-quarter face gazing intently at a test tube is taken from one of the few actual photographs of Pasteur. It has been commented upon recently as follows:

> The burden that so often accompanies genius seems to be evident in this etching which probably is of the period soon after Pasteur had mastered his attack of paralysis and again faced his detractors with overwhelming proof of his revolutionary theory, "All life from life."[14]

A surcharge 1 fr. plus 1.70 fr., dark blue green, of the Liner Pasteur was printed in 1941.

In 1927 France celebrated the centenary of the birth of Marcelin Berthelot (1827-1907), one of the most distinguished chemists of the nineteenth century, by the issue of a commemorative 90 c. dull rose stamp*. Berthelot's work, all of an original and fundamental nature, included the study of the organic acids, the synthesis of hydrocarbons, the reduction of organic compounds, reaction velocities, thermochemical reactions, and specific heats. His studies in chemical history alone will always recall his name, for he produced no less than twenty-five imposing volumes on the history of chemistry.[15] Berthelot is the only chemical historian on a stamp. A visit to Egypt in 1869 stimulated his interest in the origins of alchemy and the chemistry of the ancients. From then until his death he

[13] *Op. cit.* (see note 2, above).

[14] *The Laboratory* 15. 1.

[15] F. J. Moore, *A History of Chemistry* (New York, McGraw-Hill Book Co., 1939).

collected, translated, and edited many rare manuscripts and texts, summarizing his findings in his various books. His literary productivity was remarkable. Berthelot and his wife died within an hour of each other; he was buried in the Pantheon in Paris.[16]

Berthelot was also an important political figure; he was created a senator for life in 1881, minister of public instruction from 1886 to 1887, and minister of foreign affairs from 1895 to 1896.

The profile, after the work of the Chaplain medal, represents him when he was about seventy years old. It is reproduced in relief on the gold covers of a commemorative volume issued by the Committee Marcelin Berthelot on his centenary.[17] This postal issue is also reproduced to illustrate Berthelot's biography in Bugge.[18]

Considered as a group, the stamps honoring Henri Becquerel and the Curies tell one of the most fascinating stories in all chemical history—radioactivity. Antoine Henri Becquerel (1852-1908) was born in Paris and like his father and grandfather before him became professor of physics at the Musée d'Histoire Naturelle in Paris.[19]

After Roentgen's[20] discovery of X rays in 1895, Becquerel, attempting to determine whether rays like X rays were emitted by fluorescent bodies under the action of light, examined uranium salts. Quite by accident he found, instead of the phenomenon he expected, that uranium and its compounds emitted penetrating radiations (1896). They could pass through a considerable amount of matter and affect a photographic plate, as well as produce conductivity in gases and so discharge an electroscope. To this property Marie Curie later gave the name, radiocativity. France has recently enriched philately's gallery by honoring Henri Becquerel on a semi-postal stamp. Issued in 1946 as a 2 franc plus 3 franc violet*, it is inscribed with "Radioactivité 1896" and "Lutte contre le Cancer" (Fight against Cancer). The portrait is contemporary with his epic-making dis-

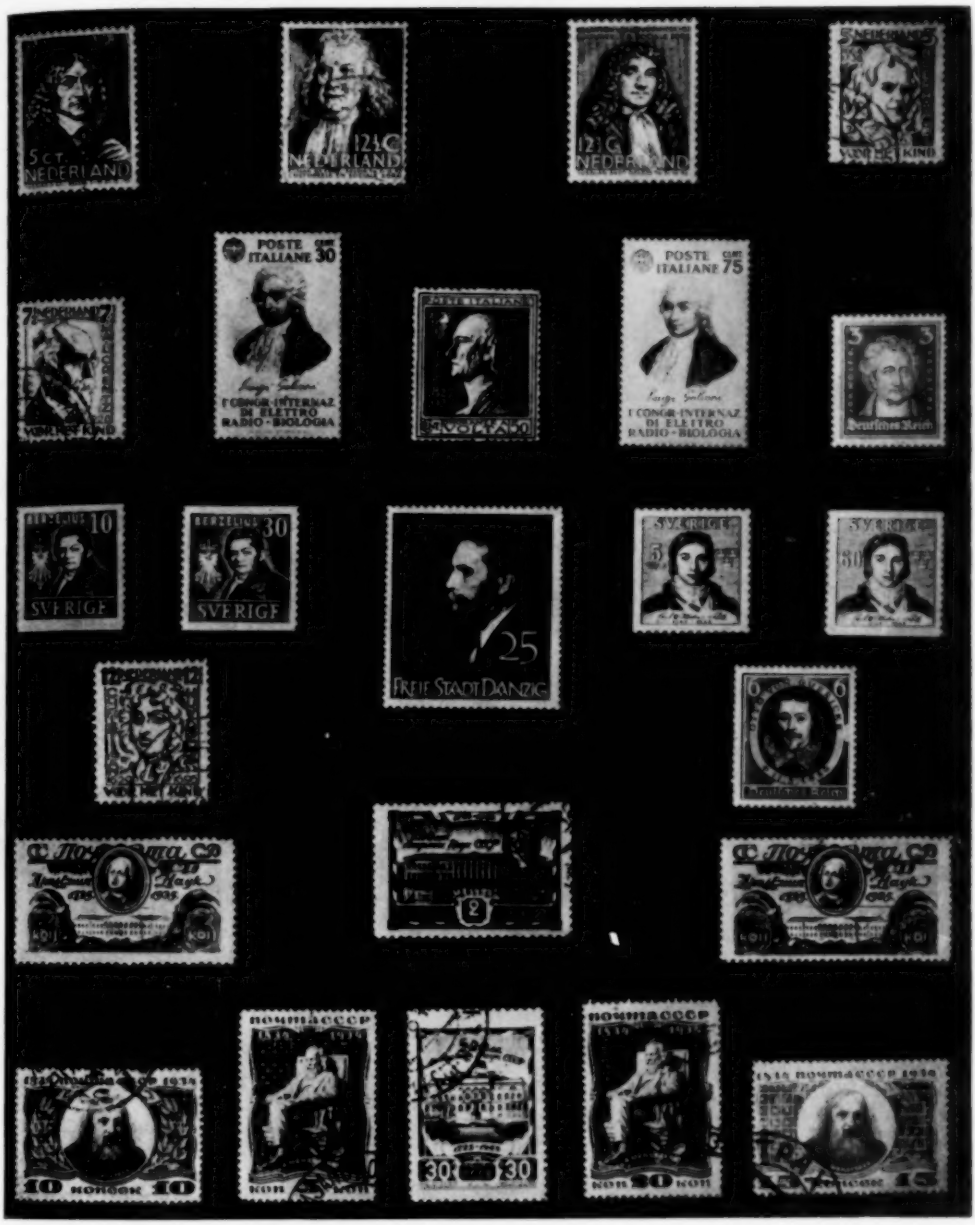
[16] W. A. Tilden, *Memorial Lectures Delivered before the Chemical Society, 1901-1913* (London 1914).

[17] *1827-1927—Centenaire de Marcelin Berthelot* (Paris 1929). This is one of the most beautiful books ever issued to honor the memory of a chemist. See also A. A. Ashdown, *Jour. Chem. Ed.* 4 (1927) 1217.

[18] *Op. cit.* (see note 2, above).

[19] He was the son of Edmond Becquerel (1821-1891), and the grandson of Antoine Beckuerel (1788-1878), both physicists who made important contributions to chemistry and physics. Henri's son, Jean, likewise became a physicist. Unfortunately, his experiments were not as successful as his father's for he was a follower of B. Blondlot and his N-rays, which were later discredited by Robert Wood. W. Seabrook, *Doctor Wood* (New York, Harcourt, Brace and Co., 1941).

[20] A stamp honoring Wilhelm Conrad Roentgen will be discussed later in this paper.



Top row—Sylvius, Boerhaave, and Leeuwenhoek; 2nd row—Lorentz, Galvani, Volta, and Goethe; 3rd row—Berzelius, Röntgen, and Scheele; 4th row—Huygens and von Guericke; 5th row—Lomonosov; 6th row—Mendeleev.

Top row—Panama issues of Marie and Pierre Curie, Antoine Lavoisier; 2nd row—M. and P. Curie; 3rd row—L. Pasteur and M. and P. Curie; 4th row—Niepce, Daguerre, Arago, M. and P. Curie, and Science; 5th row—H. Becquerel, Pasteur, M. Berthelot, and Ampere.

covery. Becquerel also carried on important work in infra-red spectra, rotatory magnetic polarization, and phosphorescence.

The development of the science of radioactivity after Becquerel's discovery is largely due to the brilliant researches of Pierre Curie and his wife, Marie Sklodowska Curie.[21] Pierre was born in Paris on May 15, 1859. He was educated by his parents and early showed promise of a fine mind. While still young, he grew to love nature and the quiet it afforded him for serious contemplation. After matriculating at the university, he began a series of studies that soon revealed him as an eminent physicist. After some remarkable work on the infra-red spectrum, he collaborated with his brother, Jacques Curie, with whom he discovered and investigated piezo-electricity. He introduced the concept of symmetry in physical phenomena in several profound papers and studied magnetic properties as a function of temperature. Most of this work was completed before he collaborated with Marie Sklodowska who became his wife in 1895.

Born in Warsaw, on November 7, 1867, Marie Sklodowska was the daughter of a professor of physics and mathematics at the Warsaw gymnasium. From him she inherited a passionate love for science. She came to Paris to study at the Sorbonne because of the limited opportunities for advanced study in her motherland. Soon her ability was recognized and several famous physicists took an interest in her work. Shortly afterwards she was introduced to Pierre Curie at the home of a Polish physicist in Paris. Their many common interests soon blossomed into love and they were married in July, 1895. Sarton's comments on them both are interesting:

> The conjecture which brought together from two very distant points (Paris and Warsaw) these two individuals, as similar as they were rare, is truly miraculous. Though brought up far apart and in very different ways, they were as alike with regard to essentials as two individuals can possibly be. Their rationalism, their passionate love of truth and of science, their indifference to money and fame, their innate austerity were equally deep and genuine.[22]

After their marriage, they worked together, he on his researches and she on the new science of radioactivity. Mme. Curie examined various minerals which contained uranium for their activity and found that their radioactivity was four to five times as great as was to be expected from

[21] See M. Caullery, *French Science and its Principal Discoveries since the 17th Century* (New York 1934); and Marie Curie, *Pierre Curie (1895-1906)* (New York, Macmillan, 1923).

[22] G. Sarton in *Isis* 28 (1938) 480.

their uranium content. This phenomenon, she explained, was due to the presence of another unknown substance, more active than uranium. Pierre soon dropped all his work and joined his wife in the search for this unknown element. After a long, laborious process of purification, they discovered (1898) an intensely radioactive substance which Marie called polonium in honor of the country of her birth, Poland. Not long afterwards they announced the discovery of radium. Pierre and Marie Curie, together with H. Becquerel were awarded the Nobel Prize in chemistry in 1903 for their work on radioactivity. Their dream of further collaboration was shattered by the death of Pierre Curie on April 19, 1906 in Paris, where he was struck by a heavy dray while crossing the street. The discovery of radium and the later work on its properties were carried out in such close collaboration that the share of either cannot be determined. Eve Curie, the younger of their two daughters, beautifully points this out in her splendid biography of her parents.[23]

After recovering from the shock caused by her husband's death, Marie undertook to raise her two children and continue her scientific studies. This she did admirably, finally succumbing to her own radium on July 4, 1934.

No two scientists have been honored on so many different issues from so large a number of countries as have the Curies. Turkey was the first country to honor Marie Curie, whose photogravure portrait appears on a 50 KU plus 50 KU dark slate green stamp issued in 1935 in connection with the 12th Congress of Women's International Alliance. All the stamps thereafter were of both Pierre and Marie together. Pierre Curie has never decorated a stamp alone.

France issued a 1.75 fr. plus 50 c. ultramarine surtax* in 1938 in commemoration of the 40th anniversary of the discovery of radium by Pierre and Marie. The surcharge was used for the benefit of the International Union for the Control of Cancer. Twenty-one of the French colonies issued the same stamp overprinted.

Monaco also printed a beautiful 65 c. plus 25 c. deep blue-green Curie stamp* in 1938. It appeared as a set with a 1.75 fr. plus 50 c. deep ultramarine stamp of a hospital, all the surtax going to the International Union for the Control of Cancer. Afghanistan produced two postal tax stamps in 1938 to pay homage to the Curies, a 10 P. peacock green of the

[23] Eve Curie, *Madame Curie (1867-1934)*. N. Y., Doubleday Doran, 1937). Translated by Vincent Sheean (Garden City,

hospital at Kabul and a 15 P. dull blue of the Curies which was a poor copy of the original French issue. Both were obligatory on all mail from December 22-28, 1938. All the money obtained from their sale was used for the hospital at Kabul. In 1938 Cuba also commemorated the 40th anniversary of the discovery of radium by issuing two engraved semi-postals of the Curies, a 2 c. plus 1 c. salmon* and a 5 c. plus 1 c. deep ultramarine.* The surtax went also to the International Union for the Control of Cancer. The appearance of the Curies on the stamps of Cuba is not surprising, for this country has presented the portraits of more famous foreigners than any other.[24] Panama also presented a group of Curie commemoratives in 1939, the money being used for the control of cancer. There were four in all, a 1 c. rose carmine,* a 1 c. blue, a 1 c. green and a 1 c. orange, all with the same engraving. The motherland of Marie, Poland, has never honored its most famous daughter with a postal issue, a shortcoming which should be corrected. France has also put out another stamp in the "Control of Cancer" campaign, showing Science fighting disease, a 2.50 fr. plus 50 c. slate brown and black.*

The portrait group in the French issues shows Marie's left profile with Pierre's full face to the left. They are examining some object, with other pieces of apparatus in the background. One of these is the piezo-electroscope invented by Pierre Curie and used by both in the radium research.[25]

The Cuban issue is a slightly modified copy of this stamp with Cuban titles inserted. Both it and the Afghanistan issue, which is an extremely poor replica, contain a crab and a bolt of lightning in the lower left corner, no doubt to signify the death of cancer since the crab was a sign of cancer among the ancients who compared the veins and hardened tissue extending from a cancerous growth to the claws of a crab.

The Monaco stamp, by far the best of the group, contains a full face of both while the Panama release has a separate block for each with a full face for Marie and a three quarter for Pierre. All the stamps show them both at the age when they discovered radium, Marie thirty-one, Pierre thirty-nine.

Marie was a beautiful young woman with ash blonde hair and blue,

[24] A. F. Kunze, *Who's Who on the Postage Stamps of Cuba* (Washington, D. C., Pan American Union, 1943).

[25] A bronze medal with the same portrait group as the stamp has been struck by the International Union for the Control of Cancer in Paris. We are indebted to Eva Armstrong, Curator, Edgar Fahs Smith Memorial Collection in the History of Chemistry, for this information.

sparkling eyes. Her transparent skin and resolute face with its Slavic cheek bones presented a picture of a determined woman. In the Sorbonne the young men would

> encounter this shy and stubborn faced girl with soft, light hair, who dressed with an austere and poverty stricken distinction, and would turn to each other in surprise, asking: "Who is it?" But the answer, if there was one, was vague. "It's a foreigner with an impossible name. She is always in the first row at the physics courses. Doesn't talk much." The boys' eyes would follow her graceful outline as it disappeared down the corridor, and then they would conclude: "Fine hair." The ash blonde hair and the little Slavic face were, for a long time to come, the only identification the students at the Sorbonne had for their timid comrade.[26]
>
> Pierre Curie had a very individual charm made up of gravity and careless grace. He was tall. His clothes, cut on ample, old-fashioned lines, hung a bit loosely about his body, but they became him; he had much natural elegance. His hands were long and sensitive. His regular, almost motionless face, lengthened by a rough beard, was made beautiful by his peaceful eyes with their incomparable look, deep, and serene, detached from all things. Although this man maintained a constant reserve and never lifted his voice, it was impossible not to notice his expression of rare intelligence and distinction.[27]

Marie described her first meeting with Pierre in simple words, but those which have fully caught the expression in the portraits on these stamps.

> He seemed very young to me, although he was then aged thirty-five. I was struck by the expression of his clear gaze and by a slight appearance of carelessness in his lofty stature. His rather slow, reflective words, his simplicity, and his smile, at once grave and young, inspired confidence.[28]

The portrait of Marie on the Turkish stamp has been taken from a widely published picture which was taken around the age of fifty-four. It appears as an autographed reproduction in a monograph printed by Vassar College in 1921, containing an address on *The Discovery of Radium* delivered by Madame Curie on her visit to America.[29] After the death of Pierre, Marie aged quickly and never looked as if she had forgotten him, even twenty years after his death. Russell describes this Madame Curie (the one we see on the Turkey issue) in his Memorial Lecture:

> She dressed most unostentatiously and, after her husband's death, mostly in black. Her face was pale and not animated in repose; but for her large, intelligent eyes, she would have seemed plain. She spoke quietly and with dignity but was not a ready talker. She was always willing to discuss science with those interested,

[26] Eve Curie, *op. cit.*
[27] *Ibid.*
[28] Marie Curie, *op. cit.*
[29] Ellen S. Richards Monograph No. 2, Vassar College, May 14, 1921. It was the only extended address she made in this country on that visit.

provided they took the lead. Her face lit up as she spoke, and one understood the attraction she possessed for those who were interested in what she was saying. She went gray fairly early and always looked rather frail. She did everything with a quiet earnestness. Her work was part of herself. She was always unassuming and quite unspoiled by success.[30]

The fixation of an image by the chemical action of light is the basic principle of photography. A German physicist, Johann Heinrich Schulze (1687-1744) first showed in 1727 that a silver chloride suspension, when exposed to the sun's rays, would turn dark. By placing stencils around bottles, he was able to produce image outlines, which he destroyed by shaking. In 1802, a paper was published on the action of light and its use in producing images by Thomas Wedgwood (1771-1805), son of Josiah Wedgwood, the famous English potter, and Humphry Davy (1778-1829).[31] The silver nitrate was coated on paper and the prepared stock was exposed to light with an object placed on its surface. Since the paper darkened where exposed to the light, a profile white image of the object resulted. They tried to fix this image, but in this they were not successful. They were also unable to record the image produced by a camera because of the limited sensitivity of their paper. The optical principles of the camera were known at this time and were used by artists for drawing designs.

In France, Joseph Nicephore Niepce (1765-1833) was working on a like process, apparently without any knowledge of the publication of Wedgwood and Davy. He succeeded where they failed, for in 1816 he produce an image on a sensitized silver chloride paper. His image was a negative, however, and since he was unable to reverse it, he abandoned the process for one which would give positive prints. He turned to asphalt coated plates, employing bitumen of Judea. Normally this substance is soluble in lavender oil but after a prolonged exposure to light, it becomes insoluble. After exposure, the areas not in the light dissolved out. These were exposed to fumes of iodine, and then the remaining asphalt was removed. An acid etch cut into the bare metal where it was not covered with iodine, and prints could be made from the plate by an intaglio process. At this time Niepce met Louis Jacques Mandé Daguerre (1787-1851), a Parisian painter who convinced him that a profit could be made from such an invention. The two formed a partnership (1829) to exploit

[30] A. S. Russell, *Jour. Chem. Soc.* (1935) 654.

[31] T. Wedgwood and H. Davy, "An Account of the Method of Copying Paintings upon Glass and of Making Profiles by the Agency of Light upon Nitrate of Silver," *Jour. Roy. Inst.* (London) 1 (1802).

the process. In 1833, Niepce died, leaving his partner to complete the work.

Daguerre so radically modified the process that it soon carried his name, daguerreotype. In 1837 he made some excellent plates but he had no success in selling the process by public subscription, and he refused to sell the secret otherwise. In 1839, François Arago (1786-1853), a French physicist best known for his contributions to magnetism and optics, heard of the invention and became interested. He suggested (January 7, 1839) to the Académie des Sciences that it should investigate the process with the idea of purchasing the secret for the people. A commission was chosen with Arago as chairman, and after six months the technique was approved and became the property of the French people on August 19, 1839.[32]

France has issued a 2.25 fr. dark blue stamp commemorating the centenary of photography in 1939-1940. The issue shows the left medallion profile of Daguerre and the right profile of Niepce on the right and left sides of the stamp, with a center engraving entitled, "Arago annonce la decouverte de la photographie le 7 Janvier 1839." This is a most interesting tribute to three men on one stamp, unparalleled in all the philatelic gallery of men of science.

The great French experimental physicist Andre Marie Ampère (1775-1836) was honored on the hundredth anniversary of his death, June 10, 1939, by the printing of a new French 75 c. brown commemorative bearing his portrait. A pupil of Louis Pasteur, A. D. Colmette (1863-1933) has appeared on a French issue. He introduced the prophylatic inoculation against tuberculosis. Claude Bernard (1813-1878), the great physiologist, decorates two surtax stamps, a 2.25 fr. plus 25 c. and a 2.50 fr. plus 25 c. bright ultramarine, both issued in 1940. The tax was used. to help unemployed intellectuals. France has also recently issued a stamp in honor of Alfred Fournier (1832-1908), a physician who waged a campaign against venereal diseases. It is a 2 fr. plus 3 fr. brown surtax which appeared at the same time as the Becquerel stamp already discussed.

The sixteenth and seventeenth centuries saw a new school of chemistry arise, iatrochemistry. The basic doctrine of this new chemistry was that the normal and pathological conditions of the human body could be

[32] B. Newhall, *Ciba Symposia* 4 (1942) 5; see also B. Newhall, *Photography, a Short Critical History* (New York, The Museum of Modern Art, 1938).

explained in terms of chemical concepts. Therefore, chemical treatments were used to combat ailments which were considered abnormal chemical conditions. One of the greatest iatrochemists was Johann Baptista van Helmont. Born in Brussels, in 1577, he attended the University of Louvain, where he completed the arts course at the age of seventeen. After studying several sciences, he finally chose medicine, and received the degree of Doctor of Medicine in 1599. He soon became an ardent follower of Paracelsus, the founder of iatrochemistry. An extended trip through Europe deeply impressed him with the importance of chemistry. As the son of a nobleman and the husband of a rich Brabant lady he was able to retire to his own laboratory in Vilvorde, near Brussels, where he spent the remainder of his life pursuing chemical investigations. As a chemist he represents the transition point from alchemy to chemistry.[33]

Van Helmont was one of the first to use a balance in his experimental work. The quantitative nature of his experiments is important, for he was the first chemist to use such a quantitative treatment in the study of plant life. Unfortunately, his training in the works of Paracelsus and his contemporaries prevented his drawing many correct conclusions. Van Helmont created the term gas—his *spiritus sylvester* or *gas sylvestre* is carbon dioxide. He was the first experimenter to understand clearly the production of gases in chemical processes. Van Helmont distinguished between gases, airs, and vapors. "His identification of the gas produced by the burning of wood charcoal with that obtained in fermentation is one of the first important generalizations in the history of agricultural chemistry."[34]

Van Helmont was also one of the early students of physiological chemistry. His knowledge of bile, gastric juice, and stomach acids was extensive. What we term enzymes resemble in many ways Van Helmont's ideas on ferments. He had some understanding of wound infection and serum immunity. He invented gravimetric analysis of urine.[35] On his death on December 30, 1644, his manuscripts were collected by his son who edited and published them in 1652.

Belgium has honored Van Helmont with one of her few stamps commemorating men of science. Issued during the German occupation in 1942 as a semi-postal 60 c. plus 10 c. greenish black stamp with a full portrait head of Van Helmont, it takes a high place in our gallery. The

[33] J. R. Partington, *A Short History of Chemistry* (London, Macmillan and Co., 1939).

[34] Browne, *op. cit.* (see note 9, above).

[35] F. H. Garrison, *An Introduction to the History of Medicine* (Philadelphia, W. B. Saunders Co., 1921).

surtax was used against tuberculosis. A stamp of Andreas Vesalius, the famous anatomist, appeared in the same series. No other chemists are found in Belgian releases.

The culmination of iatrochemistry came with Franciscus Sylvius de la Boë (1614-1672). Born in Hanau, he later studied at Sedan and Leyden, and received his doctor's degree at Basel. He practiced medicine for a time, first at Hanau, then at Leyden, and finally he went to Amsterdam, where he soon acquired the reputation of an excellent scientist as well as a physician. The University of Leyden offered him a professorship of medicine in 1658, which he held until his death.[36]

While a professor at Leyden Sylvius built a "Laboratorium" which was probably the first university chemical laboratory. Sylvius was strongly influenced in his theories by Van Helmont, but as Garrison points out, "physiological chemistry was divested of most of the fantastic trappings which Van Helmont gave by the Leyden professor."[37] He advanced much theory without any experimental proof. The tendency to accept plausible analogies to facts was too prevalent in his time. The function of ductless glands, thermal and tactile senses, and acidosis came under his consideration. His theory that the function of the body was determined by chemical processes, particularly the acidity or alkalinity of the system, was a forerunner of the modern "cult of pH".[38] Sylvius differentiated between organic and inorganic processes in chemistry. His recognition of the importance of pancreatic juice and saliva is important. Many cerebral structures bear the name of Sylvius.

The Netherlands issued a stamp in 1937 bearing the likeness of Franciscus Sylvius. Released as a 5c. plus 3c. dull green surtax stamp*, its revenue was for the summer help campaign. The beautifully engraved portrait is based on an early print.

Antony van Leeuwenhoek (1632-1723) and his "little animals" were remembered by his homeland, Holland, by the issuance of a 12 1/2c. plus 3 1/2c. dull blue charity postal* in 1937, a summer help issue. Although not a chemist, Leeuwenhoek contributed much to the early use of the microscope as a laboratory instrument. Today, microscopy is an invaluable tool in many chemical investigations. Antony was one of the most engaging figures of seventeenth century Holland. A cloth merchant and wine taster by trade, he spent all of his leisure hours at the grinding of

[36] J. M. Stillman, *The Story of Early Chemistry* (New York, D. Appleton and Co., 1924).

[37] Garrison, *op. cit.*

[38] Partington, *op. cit.*

lenses and the construction of microscopes. With these he examined any object that came to his attention. His fame grew slowly, but in time he was made a corresponding member of the Royal Society of London. In Delft, where he lived most of his life, he made over four hundred microscopes; he made great advances in the art of lens grinding. Leeuwenhoek discovered protozoa and bacteria, for which some call him the "father of protozoology and bacteriology."[39] He first described spermatozoa and red blood corpuscles. The discovery of the striped nature of voluntary muscle is attributed to him. He was also the first to prove that arteries and veins were connected by capillaries.[40] Leeuwenhoek wrote some four hundred papers on his observations.

The fine portrait engraving on the Leeuwenhoek stamp is based on the work of the Dutch artist Johannes Verkolje (1650-1693), who lived in Delft from 1673 until his death and was buried there. He is a contemporary of Jan Vermeer (1632-1675). Verkolje made two portraits of Leeuwenhoek, an oil painting and a mezzotint engraving. The stamp is based upon the latter. The oil painting was done in 1686, when he was fifty-four years of age, and is a

> three quarter length, showing Leeuwenhoek seated at a table, wearing a golden brown robe, a wig, a knotted white handkerchief, etc., head turned to the left of the picture (i.e., to his own right), knees to right. On the table a globe, an ink stand with a quill pen, the sealed diploma of the Royal Society, a small pair of compasses, and a sheet of paper bearing a drawing of a circle and some indistinct figures. In his right hand he holds another pair of compasses. He is depicted with a fresh complexion and clear blue eyes. An opening at the right in the dark background shows a glimpse of a distant landscape with a winding river.[41]

The painting was last in the Rijksmuseum, Amsterdam, but its fate at the hands of the Germans is not known. Dobell describes the mezzotint as differing from the painting in the following details:

> The head is turned to the right, knees to the left, and Leeuwenhoek holds a microscope in his left hand (not compasses in his right). The whole picture is, in fact, reversed; on the table instead of the diploma there is a spray of oak leaves with galls on them, and a large magnifying glass with a handle. A curtain hangs behind the head and the distant landscape is missing.

The mezzotint is also signed with the date 1686 which confirms the oil painting. It is quite apparent that Verkolje first painted the oil portrait

[39] C. Dobell, *Antony van Leeuwenhoek and His Little Animals* (London, John Bale Sons and Danielson Ltd., 1932).

[40] H. S. Reed, *A Short History of the Plant Sciences* (Waltham, Mass., Chronica Botanica Co., 1942).

[41] Dobell, *op. cit.*

and shortly afterwards engraved it in mezzotinto. Copying the painting directly on the plate would account for the reversal on pulling the prints. Several changes were made in minor objects. The reversal made Leeuwenhoek appear left handed, something the artist overlooked. Although only the head and shoulders are shown on the stamp, it is a faithful reproduction of Verkolje's work. Dobell states that the "mezzotint by Verkolje is probably the best of all the portraits of Leeuwenhoek." Richardson discerns "the quiet force of Cromwell and the delicate disdain of Spinoza in this portrait."[42]

This same likeness has been copied for many illustrations, being quite distorted in the process by crude techniques or reproduction. A wax die seal used by Leeuwenhoek was incised from the mezzotint. The wax impression of this seal has been used to date some of Leeuwenhoek's letters, for it was made shortly after the mezzotint by Verkolje. Its minute details are remarkable. Plaques, medallions, tile, and pottery ware as well as tooth paste advertisements bear the same portrait. "But the last stage in degradation has surely been reached in the caricature imprinted on the cover of the American Abstracts of Bacteriology."[43]

Hermann Boerhaave (1668-1735), "a name cherished among chemists,"[44] has twice apeared on the postal issues of Holland. In 1928 a 5 c. plus 3 c. green photogravure stamp* was issued. The surtax was used for the benefit of child welfare societies. In 1938 appeared a 12½ c. plus 3½ c. dull blue surtax* with Boerhaave's portrait, the revenue going to the cultural and social relief fund.

Born at Voorhout, near Leyden, the son of a clergyman, Boerhaave seemed destined for the church, but an interest in Spinoza led him to studies in science, to which he soon turned all his attention.[45] He received a degree in medicine at the University of Harderwyk in 1693. In 1702 he was appointed to a professorship of medicine at Leyden. Here his fame became world wide, not only as a physician, but as a chemist and botanist as well. Boerhaave was "one of the greatest figures in the transition period of chemistry, when old theories were being tested in the light of new knowledge."[46] Although he made no striking discoveries, his texts and teachings helped to systematize and spread the science of chem-

[42] B. W. Richardson, *The Asclepiad* 11 (1885) 319.

[43] Dobell, *op. cit.*

[44] E. F. Smith, *Old Chemistries* (New York, McGraw-Hill Book Co., 1927).

[45] A. Wolf, *A History of Science, Technology and Philosophy in the Eighteenth Century* (New York, The Macmillan Co., 1939).

[46] Browne, *op. cit.* (see note 9, above).

istry to all. His book *Elementa Chemiae* was one of the most popular treatises of the period. Its Latin version alone went through ten editions, and it was translated into English, French, and German as well.[47] Browne states that the "'Elements' contains a history of chemistry (64 pages) which is one of the best accounts of the early development of the science that has ever been written." Thomson says, "the work was undoubtedly the most learned and most luminous treatise on chemistry that the world had yet seen; it is nothing less than a complete collection of all the chemical facts and processes which were known in Boerhaave's time."[48]

The reputation of Boerhaave attracted a great number of students to Leyden. He raised the university to a most eminent position. Kopp[49] refers to his years of professorship as one of the most glorious periods in the university's history. The Edinburgh Medical School was founded by pupils of Boerhaave. Some of the leaders of the "Old Vienna School" were his followers. A. von Haller and G. van Swieten, two of his more famous disciples, have been honored by postage stamps.

Albrecht von Haller (1708-1777) was the most important physiologist of his day. Born to parents of the aristocracy in Switzerland, he soon displayed such talent in his studies that he was considered a child prodigy. While at Leyden, he came under the influence of Boerhaave. He studied botany and poetry as well as medicine, becoming most proficient in both. In 1736 he was called to the University of Göttingen to create a medical faculty which he did with the aid of his former professor. Physiology profited much from his many contributions. Haller was "modest, sensible, kindly, and charitable, and—rare trait—not afraid to affirm his ignorance."[50] Switzerland, of whose beauties he wrote in his poems, paid homage to him by issuing a 30 c. plus 10 c. ultramarine engraved stamp in 1934, watermarked with a Greek cross.

Another of Boerhaave's students, Gerhard van Swieten (1700-1772), was summoned to Vienna by the Empress Maria Theresa. Here he reorganized the medical school, and using Leyden as a model, he established the "Old Vienna School." He has been twice honored by philatelic portraits. Austria issued his stamp (1937) in the physicians series printed to commemorate famous Austrian physicians. The 5g. plus 5 g. chocolate stamp bears a left profile of Swieten. The surtax was used for several

[47] F. Hoefer, *Histoire de la chimie* (Paris 1869).

[48] T. Thomson, *The History of Chemistry* (London, 1830-31).

[49] H. Kopp, *Geschichte der Chemie* (Braunschweig 1843-47).

[50] Garrison, *op. cit.*

charities. In 1938 the Netherlands issued a 3 c. plus 3c. vermillion surtax with a three quarter face portrait.

Jan Ingen-Housz (1730-1799) was a Dutch biologist who was able to do much scientific research because of his wealth. He first practiced medicine in Holland, but later moved to London. During his residence there, he became acquainted with the work of Joseph Priestley. His studies of plants soon brought him fame. After a ten year stay in Vienna as court physician, he returned to England. Here he pulished a book[51] in which he showed that the restoration of air by plant life was dependent on the amount of illumination. Ingen-Housz pointed out that leaves require the light of the sun rather than the influence of its heat, and the light, not the warmth, is the chief if not the only cause which makes plants yield their "dephlogisticated air." At that time he was under the influence of the phlogiston theory, but he later accepted some of Lavoisier's new chemical ideas. Ingen-Housz was thus the discoverer of photosynthesis and understood it as a process distinct from respiration. After returning for a year to Vienna in 1780, he once again came to London where he lived for the rest of his life. The Netherlands have added Ingen-Housz to the philatelic gallery with a 2½ c. plus 2½ c. dark slate green charity stamp (1941). Its surtax was used for cultural and social relief organizations.

In 1940 a 3 c. plus 3 c. carmine Netherlands issue honoring Pieter Camper (1722-1789) appeared. Camper was an artist by training and later turned to medicine. He illustrated many of his later works, and constructed anatomic models. Frans Cornelis Donders (1818-1889) "the physiologist and ophthalmologist to whom the world is indebted for valuable contributions on the physiology of respiration and vision"[52] can be found on a 6 c. plus 4 c. myrtle green stamp (1934).

The versatile genius, Christian Huygens, was born in the Hague on April 15, 1629. After an excellent training in mathematics, literature, and music, he studied law at the University of Leyden. Later at Breda his mathematical interests soon pushed aside all legal matters. In time he became distinguished as a mathematician, astronomer, and physicist. He perfected the telescope lens, the pendulum clock, and explained what today we know as centripetal force. The ideas of dynamic mass and the center of oscillation were introduced by Huygens. His wave-front, or

[51] J. Ingen-Housz, *Experiments upon Vegetables Discovering Their Great Power of Purifying the Common Air in the Sunshine and of Injuring It in the Shade and at Night* (London 1779).

[52] Schaeffer, *op. cit.* (see note 5, above).

Huygens principle, has explained many phenomena. Many of his fundamental studies serve as a foundation for modern physical chemistry.[53] A 12½ c. plus 3½ c. ultramarine issue* in 1928 bears a portrait of Huygens by Ottens.[54]

Another Dutch physicist, Hendrick Anton Lorenz (1853-1928), has been remembered by a postal issue bearing his likeness (1928), a 7½ c. plus 3½ c. vermillion*. Lorenz independently deduced the theoretical relationship between refractive index and density in 1880.[55]

Since the chemical heritage of Germany is rich, it is disappointing to find that she has remembered few of her chemists on stamps. Portraits of several physicists and physicians have apeared, most of them far less important than her chemists. However, they have a place in this study, since their basic investigations opened new fields of chemistry. Although Germany has not reproduced the portraits of chemists, she has printed a stamp with the picture of a chemist at work in the laboratory. It was issued in 1934 as a 20 pf. plus 10 pf. prussian blue stamp, one of several in a winter help release.

In 1936 Germany issued a 6 pf. dark green stamp* in commemoration of the 250th anniversary of the death of Otto von Guericke, May 11, 1686. For 35 years, von Guericke (1602-1686) was burgomaster of Magdeburg where he was born. He studied law at Leipzig, Jena, and Helmstaat. While at Leyden, he was attracted to the study of physics and mathematics. Entering political life at an early age did not interfere with his physical researches. All his spare time was spent in his laboratory. Von Guericke soon proved himself to be a most gifted investigator, being one of the first to break away from the "old scholastic school." In the history of pneumatics he is known chiefly for his invention of the air pump in 1650 and for the very important experiments he performed in constructing the air pump.

I filled a cask with water, made it everywhere air tight, connected it on the lower side with a metal pump wherewith to draw out the water. I reasoned that as I drew out the water the part of the cask above the water would be then empty space. At the first experiments the cask flew to pieces; I then affixed heavier screws, three men succeeded in pumping out the water, but then a sizzling sound was heard, the air filled the space from which the water was drawn. Then I tried putting a smaller cask within the larger, so as to avoid the air rushing into the empty space

[53] H. Crew, *Portraits of Famous Physicists with Biographical Accounts* (New York, Scripta Mathematica, Yeshiva College, 1942).

[54] *Bibliotheca Chemico-Mathematica* (London, Henry Southeran and Co., 1921).

[55] S. Glasstone, *Text-book of Physical Chemistry* (New York, D. Van Nostrand Co., 1940).

and drawing thence the water. Again the sound, now like the twittering of a bird, was heard and lasted for three days, for the wood was porous and let the air through. Therefore I tried a copper sphere instead; first this burst with a loud report. I attributed this to a probable defect in the spherical shape. With the greatest care I had a perfect sphere constructed. Now finally a vacuum was obtained; opening the cock to the sphere, the air rushed in with great violence. In order to show my experiments to the Elector of Brandenburg, I devised the following apparatus, which was easily portable.[56]

From this point on he described what we know today as the air pump. With the void he created he discovered that animal life cannot exist in a vacuum and that all bodies fall at the same rate in it. His deduction that gases have weight resulted in his inventing the air balance and the anemoscope. The construction of a giant barometer enabled von Guericke to predict weather changes with amazing accuracy. This brought him into disrepute as a sorcerer.[57]

His large scale epic experiments of the "Magdeburg hemispheres," which when evacuated were held so strongly together by atmospheric pressure that two teams of light horses were needed to pull them apart, is his most famous work.

To von Guericke goes the credit for being among the first to notice the phenomenon of electric light. It was he who proved that light could pass through a vacuum. He also showed that sound must have some propagating medium. His investigations on electrical machines were important. The portrait on the stamp honoring von Guericke is after a portrait by Anselm van Hulle.[58]

Contemporary with Guericke was Gottfried Wilhelm Leibnitz, whose likeness appears on a 40 pf. deep violet stamp issued by Germany in 1926.

Among those who incarnated the change of civilization, no name next to Bacon's should be given greater prominence than that of Leibniz. Nor is it enough to call him a pioneer; he is a creator and spokesman of those special elements which characterize modern times in distinction to the Middle Ages.[59]

He left his mark not only as a scientist, but as a historian, philosopher, and mathematician as well. Leibnitz independently discovered differential calculus. He was personally acquainted with Brand and Krofft, and

[56] M. Ornstein, *The Role of Scientific Societies in the Seventeenth Century* (Chicago, The University of Chicago Press, 1938).

[57] O. Glasser, *Amer. Jour. Roentgen. Rad. Ther.* 30 (1933) 2, 3.

[58] Ornstein, *op. cit.*

[59] L. Keller, *Gottfried Wilhelm Leibniz und die Deutschen Societäten des 17. Jahrhunderte* (Berlin 1903).

wrote a detailed account of the discovery of phosphorus, including biographical sketches of Brand, Krofft, Kunckel, and Becher.[60]

"To the world in general Goethe is well known as a man of letters, but the fact that he was also a scientist of considerable ability is seldom realized because his literary fame completely eclipsed his scientific skill."[61]

Johann Wolfgang von Goethe was born in Frankfurt-am-Main in 1749. He was the son of a wealthy public official who gave him a sound elementary education. The period in which he grew up was one of turmoil and depression, one in which the people turned to philosophy and religion for refuge. Many secret societies sprang up, some based on the lore of ancient alchemy. Goethe went to Leipzig in 1765 to study law, and there became interested in alchemy. During his recovery from an illness in 1769, under the influence of some friends who were ardent members of a mystic religious organization, he began to study the work of Paracelsus. A laboratory which he outfitted showed him the importance of experimental work in the study of chemistry. An interest in iatrochemistry also led him to study the works of Basil Valentine and van Helmont. When he returned to Strassburg in 1770 to continue his interrupted law studies, he also took a course in chemistry. Goethe later admitted that chemistry had always been his secret love. A visit to the Saar district aroused his interest in the technical chemistry of glass, smelters, and coal. He presently abandoned the study of alchemy. An appointment as public administrator in the court of Weimar in 1775 gave him further opportunities to continue his studies in the technical aspects of chemistry. He realized the importance of chemistry in the study of mineralogy, and in 1776 seriously considered giving up his literary work for chemistry.

The greater number of Goethe's experimental researches were carried out with Johann Wolfgang Döbereiner (1780-1849), the discoverer of the triads. Later he helped outfit Döbereiner's laboratory when the latter was called to a professorship at Jena. Together they investigated the preparation and uses of water and illuminating gases, the production of new alloys from manganese and silicon with iron, the synthesis of oxalic acid from carbon monoxide and dioxide, the destructive distillation of wool, and the preparation of sugar from alcohol and carbon dioxide. Göttling worked with Goethe on the commercial extraction of sugar from sugar

[60] M. E. Weeks, "Discovery of the Elements," *Jour. Chem. Ed.* (1945).

[61] A. J. Gehrt, *Jour. Chem. Ed.* 11 (1934) 543.

beets. Contemporary chemists, e.g. Berzelius and Rose, regarded Goethe's work with much esteem. Today a crystallized form of hydrated ferric oxide, goethite bears his name. His interest in chemistry continued until his death in 1832. Many of his immortal works, notably Faust, contain references to chemistry.

Germany honored Goethe in 1926 with a 3 pf. olive brown postal release* bearing his full face portrait. There is little doubt that it was issued for his literary and political accomplishments rather than for his chemical works, but its presence in philately reminds one that he was a chemist as well.

Germany has also dedicated a stamp to Emil von Behring (1854-1917) who discovered (1890) the "possibility of passive immunization of animals and men against tetanus and diphtheria, by the injection of serum from animals that had been actively immunized by repeated injection of diphtheritic toxin."[62] His work led to the concept of antitoxins. Two different denomination stamps bear his portrait, and both were isued in 1940, a 6 pf. plus 4 pf. deep green and a 25 pf. plus 10 pf. bright ultramarine.

Robert Koch (1843-1910), the "father of bacteriology," who also interpreted the life history of the anthrax bacillus, and discovered the tubercle bacillus, appears on a German postage stamp. It was issued during the war (1944) as a 12 pf. plus 38 pf. sepia colored release to commemorate the centenary of his birth.

Danzig[63] has also honored Koch with an indigo 15 pf. stamp which carries the motto "Air and sun, the enemies of tuberculosis."

Another of the Danzig scientist stamps bears the likeness of Wilhelm Konrad Röntgen (1845-1923), the physicist who in 1895 discovered X rays. Röntgen's epic work came at a time when most scientists held a dismal view of the future of physics; it changed many basic concepts of physics and chemistry. Glasser[64] feels that the best description of Röntgen's discovery was given by Sylvanus F. Thompson, the English physicist, in an address on November 5, 1897, to the then new British Röntgen Society.

> November the eighth, 1895, will ever be memorable in the history of science. On that day a light which, so far as human observation goes, never was on land or

[62] A. Castiglioni, *A History of Medicine* (New York, Alfred A. Knopf, 1941).

[63] In 1920 Danzig was established as a Free City and State under the League of Nations; it was seized by Nazi Germany in 1939. The scientists issue was made prior to the occupation.

[64] O. Glasser, *Wilhelm Conrad Röntgen and the Early History of the Röntgen Rays* (Chicago, Charles C. Thomas, 1934); see also *Am. Jour. Roentgen. Rad. Ther.* 25 (1931) 4; 34 (1934) 5.

sea was first observed. The observer, Prof. Wilhelm Conrad Röntgen. The place, the Institute of Physics in the University of Würzburg in Bavaria. What he saw with his own eyes, a faint, flickering greenish illumination upon a bit of cardboard painted over with a fluorescent chemical preparation. Upon the faintly luminous surface a line of dark shadow. All this in a carefully darkened room, from which every known kind of ray had been scrupulously excluded. In that room, a Crooke's tube, stimulated internally by sparks from an induction coil, but carefully covered by a shield of black cardboard, impervious to every known kind of light, even the most intense. Yet in the darkness, expressly arranged so as to allow the eye to watch for luminous phenomena, nothing visible until the hitherto unrecognized rays, emanating from the Crooke's tube and penetrating the cardboard shield, fell upon the luminous screen, thus revealing their existence and making darkness visible.

From seeing the illumination by the invisible rays of a fluorescent screen, and the line of shadow across it, the work of tracing back that shadow to the object which caused it, and of verifying the source of the rays to be the Crooke's tube, was to the practised investigator but the work of a few minutes. The invisible rays—for they were invisible save when they fell on the chemically painted screen—were found to have penetrative power hitherto unimagined. They penetrated cardboard, wood, and cloth with ease. They would even go through a thick plank or a book of 2000 pages, lighting up the screen placed on the other side. But metals such as copper, iron, lead, silver, and gold were less penetrable, the densest of them being practically opaque. Strangest of all, while flesh was very transparent, bones were fairly opaque. And so the discoverer, interposing his hand between the source of the rays and his bit of luminescent cardboard, saw the bones of his living hand projected in silhouette upon the screen. The great discovery was made.

The value of X rays in medicine is well known. Their use against malignant neoplasms explains the motto "Fight cancer, cancer is curable" on the Röntgen stamp. Their contributions to crystallography, metallurgy, and chemistry have been great. X-ray analysis[65] has been of great service in chemical investigations.

The portrait of Röntgen on the Danzig issue is based on a photograph taken at the time of his discovery of X rays when he was fifty years old.[66] A bronze bas-relief by Heinz Peter has also been made after the likeness on the stamp. After the first World War emergency paper money issued in Lennep and Wilhelm also bore a picture of Röntgen.

In 1936 Austria issued a series of stamps dedicated to famous Austrian inventors and technicians. Among them is a 40 g. plus 40 g. gray violet bearing the head of Carl Auer, Freiherr von Welsbach, whose famous Welsbach gas mantle was once known to all. Born on September 1, 1858 in Vienna, Auer completed his early studies in the Polytechnicum. [67] He

[65] L. Bragg, *The History of X-ray Analysis* (London, Longmans Green and Co., 1943).

[66] O. Glasser, *Radiog. Clin. Photog.* 8 (1932) 1.

[67] *Jour. Chem. Ed.* 6 (1929) 2051; Castiglioni, *op. cit.*

later went to Heidelberg to study with Bunsen, whose favorite he quickly became. His chief interest was in inorganic chemistry, especially in the rare earth minerals. With Bunsen's guidance he began the study of the rare earths which was destined to be his life work. In 1885 he discovered praseodymium and neodymium by the repeated fractionation of ammonium didymium. Perhaps Carl Auer is best remembered for his many contributions to illumination. Making use of his vast knowledge of the rare earths, he invented the "Auerlicht" or Welsbach mantle, the osmium filament electric bulb, and the automatic gas lighter. For his work Kaiser Franz Joseph gave him the hereditary title of Baron in 1901. His laboratory was later housed on the ground floor of his castle. Here, in addition to his apparatus, he had a valuable collection of books and an extensive cabinet of rare earths. The castle was also surrounded by a garden where he spent much time tending plants; the country afforded him recreation in hunting and fishing. Weeks cites D'Ans[68] who described Auer's sudden death, for after being seized with severe abdominal pains and being told that his condition was serious,

> he got up, went into the garden, looked around, closed up his study, burned a few papers, stood for a long time before his father's portrait, then went into the laboratory, covered his spectroscope, stroked it tenderly with his hand, glanced at the other things, took leave of his last unfinished thulium series with a motion of his hand, closed the room again and quietly lay down.

Some twelve hours later he was dead.

Austria also was the first to issue a series of medical stamps, which were dedicated to the "New Vienna School." It was a surtax release, with the money being used for various charities. The physicians issue consisted of nine stamps in all; the first, Gerhard van Swieten, has already been discussed under the Netherlands. An 8 g. plus 8 g. dark red stamp was issued to honor Leopold Auenbrugger v. Auenbougg (1722-1809) who invented percussion, now an indispensible technique in physical diagnosis; a third, a 12 g. plus 12 g. brown black bears the portrait of Karl von Rokitansky (1804-1878), one of the founders of modern pathologic anatomy. Joseph Skoda (1805-1881) who was the greatest clinician of the "New Vienna School" appears on a 20 g. plus 20 g. dark green release. The founder of systematic dermatology, Ferdinand von Hebra (1816-1880) is the fifth in the series, on a 24 g. plus 24 g. dark violet. Eye dis-

[68] In Castiglioni, *op. cit.;* see J. D'Ans, *Ber.* 64 (1931) 59-92.

eases were studied by Carl Ferdinand von Aret (1812-1887), who is on the 30 g. plus 30 g. brown carmine stamp. One of the leaders in descriptive anatomy, Josef Hyrtl (1811-1894), decorates a 40 g. plus 40 g. deep olive green issue. The surgeon Theodor Billroth (1829-1894) is found on the 60 g. plus 60 g. indigo release. The last in the series is dedicated to Theodor Meynert (1833-1892), professor at Vienna and contributor of many important studies on the anatomy and physiology of the brain. It is a 64 g. plus 64 g. brown violet stamp.

Hungary has remembered Ignaz Filipp Semmelweis (1818-1865) who fought against puerperal fever, on a 4 f. ultramarine stamp (1932).

Johannes Evangelista Purkinje (1787-1869) adorns two stamps issued in commemoration of the 150th anniversary of his birth, a 50 h. slate green and a 1 K. dull rose. This great Czech physiologist and histologist created the foundations of ophthalmoscopic examination and dactyloscopy.

An American, Nikola Tesla (1857-1943) has been portrayed on several postage stamps of his native country, Yugoslavia, issued in 1936 as a 75 p. yellow green and dark brown and a 1.75 d. dull blue and indigo.[69] A high voltage transformer also bears his name.

Dr. Ignaz Moscicki whose picture decorates many Polish stamps is of great interest since he was first a chemist and later President of Poland (1926). He was born at Mierzanaw, Poland, in 1867. In 1891 he graduated from the Riga Polytechnic as an engineer. After several years of industrial work in England he returned to the continent as assistant to Kowalski at the University of Freiburg. The fixation of nitrogen by the use of electric arcs interested Moscicki, who in 1903 constructed a pilot extraction plant. After much experimentation he evolved a method that proved quite successful, and which produced much of the nitrate needed by Switzerland during the first World War. Moscicki designed heavy condensers for his work and was able to produce concentrated nitric acid. The preparation of hydrocyanic acid from nitrogen was also solved by Moscicki. His native land recalled him to Lwow as professor of physical and electrochemistry in 1912. Here he investigated petroleum products, created a nitrogen industry, and did much to raise the chemical world of Poland.

[69] J. J. O'Neill, *Prodigal Genius; the Life of Nikola Tesla* (Washburn 1944). This is the first biography of Tesla. He is the only American man of science to be honored on a European stamp. Gorgas has appeared on a Panama stamp, and the Argentine Republic has issued Samuel F. B. Morse and Alexander Graham Bell postage stamps. Peru has also commemorated Morse for his invention of the electric telegraph.

Deservedly popular for what he had contributed to the welfare of his country, this eminent man of science and technology, to whom the Polish chemical industry owes so much, was made President of the Polish Republic in 1926. Not the least among his other notable qualifications was the fact that he had not previously engaged in political activities. He served with such distinction that he was elected for a second seven year term in 1933. No chemist has ever occupied such a high political position, and his career is a shining example of the truth of the idea that a scientific training is the best possible preparation for governmental responsibilities.[70]

A 20 g. red stamp was issued to honor Moscicki a year after he became president of Poland. Many others followed—a 1 z. black cream in 1928, a 3 z. black brown in 1935, a 15 g. slate green and a 30 g. rose violet in 1938, both with the same portrait. Souvenir stamp sheets have also been released commemorating Moscicki.

Poland has also recalled the work of Karol Kaczkowski (1797-1868), professor of therapeutics and hygiene who became a surgeon general, and Nikolaus Copernicus, the astronomer, on stamps. One of the shortcomings of Poland in the field of philately is that she has not honored her most famous daughter, Marie Curie, who did so much for her motherland. She showed her devotion to her country by naming the element polonium, and later established a radium institute in Poland, presenting some radium as a gift. Fellowships supported by her brought Polish students to her laboratory. Perhaps someday Poland will rectify this gross injustice.

Turning to Italy, we find stamps which portray two most interesting men in the history of electricity, Luigi Galvani and Alessandro Volta. Born in Bologna, Galvani (1737-1798) first studied theology and law, but later turned to medicine as a career. In time he became professor of anatomy in Bologna. At twenty-five he presented a thesis "On Bones" in which he described their structure, formation, and chemical nature. His work in comparative anatomy was of great value. It was in 1791 that Galvani made the discovery for which he is remembered today.[71] He described how one day when he was preparing frog legs to make a broth for his wife,[72] who was sick, he observed that the legs would contract violently when touched by a scalpel that was near an electrical machine. From this chance observation he began a series of systematic experiments. He soon evolved a metallic arc made of two different metals, which, when placed in contact with a frog muscle and nerve would cause contraction.

[70] R. Oesper, *Jour. Chem. Ed.* 14 (1937) 359.
[71] A. Castiglioni, *Ciba Symposia* 7 (1945) 97.
[72] Lucia Galeazzi Galvani, daughter of Domenico Galeazzi, professor of anatomy, who inspired Galvani. She was an active collaborator in his scientific work.

This arc is the fundamental principle of the modern galvanic battery. Unfortunately, Galvani did not interpret his observations correctly, for he named the new force "animal electricity" believing it originated from the organs of the animal. His animal electricity was

> supposed to flow from the brain through the nerves and so to the muscle, which he likened to the Leyden jar, supposing the surface and interior surface of a muscle to be oppositely charged. Upon bringing into contacting communication the nerves and surface of the muscle (which respectively corresponded to the inside and outside of the jar) a discharge took place of which he conceived the muscular contraction to be a consequence.[73]

Galvani's later life was a tragedy. When Napoleon entered Italy in 1796, he was removed from office, and he died before his greatness was sufficiently recognized for his reappointment.

It was Alessandro Volta (1745-1827), a contemporary, who showed the correct meaning of Galvani's researches. In his report to the Royal Society of London on January 31, 1793, he described Galvani's works in detail, praising them highly, and asserting that they were the foundation upon which other discoveries were to be made. Volta attributed the contraction of the muscles solely to the effect of electricity produced by the junction of two different metals, and considered the nerve and muscle to be only conductors.[74] Volta was professor of physics at Como, attaining this distinction before he was thirty. He later became professor at the University of Pavia and in 1815 was made head of the Philosophical Faculty at Padua. His studies prior to Galvani's work were on the properties of gases, although he also produced much in the field of electricity. Volta traveled a great deal throughout Europe and came into contact with many famous scientists, Arago, Davy, Lavoisier, Priestley and others. One of his most important discoveries was the "Volta Pile" which was based on his many experimental observations. His potential series is classical in chemistry. The voltaic cell was the end product of the work of Galvani and Volta.

Italy issued two denominations of a stamp honoring Luigi Galvani in 1934, a 30 c. brown buff* and a 75 c. carmine rose*. It was a radio congress commemorative issue. The likeness reproduced on the stamp is the familiar one found in all studies of his work and is probably based on a portrait in the Library of the University of Bologna. The Academy of Sciences of Bologna in their one-volume collection of Galvani's works

[73] Wolf, *op. cit.* (see note 45, above).

[74] Castiglioni, *op. cit.* (see note 71, above).

reproduce this same picture as the frontispiece.[75] Volta appeared on an Italian stamp in 1927, commemorating the one hundredth anniversary of his death. Several typographical stamps were issued all bearing the same full left face profile of a Volta bust—a 20 c. dark carmine, a 50 c. greenish black*, a 60 c. chocolate and a 1.25 lira ultramarine. The same likeness is found as an inserted circular print on each of the top covers of the Volta collected works published in 1918.[76]

To Sweden belong two of the greatest names in the history of chemistry, Scheele and Berzelius. She has remembered them both in the philatelic gallery. Carl Wilhelm Scheele (1742-1786), "whose brilliant investigations mark him as one of the greatest chemists of all time"[77] was born on December 9, 1742 at Stralsund, in Swedish Pomerania.[78] The seventh child in a family of eleven, Scheele was apprenticed to Bauch, an apothecary of Gothenburg, when only fourteen. Here he found and read all the chemical books within his grasp, repeating in his spare hours the experiments described in them. Soon his acute memory collected a vast amount of data, and he struck out into original work. After eight years with Bauch, he went to Malmö (1765), then to Stockholm (1768) where he took charge of the Scharenberg pharmacy. In 1777 he bought a shop in Köping where he died some years later. In these pharmacies he made all of his discoveries. Thorpe summarizes the discoveries of Scheele, many of them of incalculable importance, as follows:

> First isolated chlorine and determined the individuality of manganese and baryta. He was an independent discoverer of oxygen, ammonia, and hydrogen chloride. He discovered also hydrofluoric, nitro-sulfonic, molybdic, tungstic and arsenic among the inorganic acids and lactic, pyrogallic, gallic, oxalic, citric, tartaric, malic, music and uric acids among the organic acids. He isolated glycerine and milk sugar; determined the nature of microcosmic salt, borax, and Prussian blue, and prepared hydrocyanic (prussic) acid. He demonstrated that graphite is a form of carbon. He discovered the chemical nature of sulfuretted hydrogen, arseniuretted hydrogen, and the green arsenical pigment known by his name. He invented new processes for preparing ether, powder of algaroth, phosphorus, calomel, and magnesia alba. He first prepared ferrous ammonium sulfate; showed how iron may be analytically separated from manganese; and described the method of breaking up mineral silicates by fusion with alkaline carbonates.[79]

Urdang adds still more to this comprehensive list, for "Scheele further-

[75] *Opere edite ed inedite del Professore Luigi Galvani* (Bologna 1841).

[76] *Le opere di Alessandro Volta* (Milano 1918).

[77] Browne, *op. cit.* (see note 9, above).

[78] E. Kremers, and G. Urdang, *History of Pharmacy—a Guide and a Survey* (Philadelphia, J. B. Lippincott Co., 1940); E. J. Holmyard, *Makers of Chemistry* (Oxford 1931).

[79] T. E. Thorpe, *History of Chemistry* (London 1909).

more invented a new process for preparing benzoic acid—discovered nitrous acid—fluosilicic acid—and benzoic acid."[80] With all his many achievements "he was a modest, unassuming man of almost saintly character and so indifferent to fame that although one of the greatest chemists of all time, he lived and died in comparative obscurity."[81] The Carl Wilhelm Scheele stamp was issued in 1942 in commemoration of the 200th anniversary of his birth. It can be had in two colors, a 5 ö. green* and a 60 ö. deep magenta*. The design of the stamp is a full face portrait of Scheele with his signature below. Scheele always signed documents with "Apothekare" below his name, indicative of his modesty and devotion to pharmacy. "The portrait on the stamp is a somewhat retouched copy of the only authentical picture of Scheele that has come down to us."[82] It shows him at about the age of twenty-five. "The original, a painted ivory medallion, was discovered by S. Gullström on September 20, 1931 when he finally succeeded in running down a clue encountered in 1929."[83] It was not long after his death that the importance of Scheele's work was recognized. In a lecture given before the Swedish Royal Academy of Science in 1789 (three years after his death) the following was said:

> Although Scheele like a blazing comet passed our horizon with great velocity, disappearing after having been scarcely observed, yet the splendor of his genius has incited the attention of all, has spread light on the broad field of chemistry, has paved the way for others, and gained for himself an imperishable monument in the memory of chemists, and naturalists and all who love science. His name cannot be forgotten as long as fire and air remind the mortals of the discoveries given to them with regard to these substances by Scheele, and his honor, based on his own merit, resists all change of time.[84]

J. J. Berzelius (1779-1848) was an equal of his fellow countryman, Scheele, although in a different phase of chemistry. Born at Väversunda on August 20, 1779, he showed little ability in his early studies. After taking his degree in medicine in Upsala, he began experimental work which soon brought him fame and a professorship of chemistry in the University of Stockholm. Later he accepted a chair in chemistry at the Chirurgico-Medical Institute at Stockholm. He showed

> that the laws of combination and atomic theory applied in both inorganic and organic chemistry (1810), introduced a classification of minerals based on chemical

[80] *Op. cit.* (see note 3, above).
[81] Browne, *op. cit.* (see note 9, above).
[82] Urdang, *op. cit.* (see note 3, above).
[83] *Jour. Chem. Ed.* 14 (1937) 2.
[84] Urdang, *op. cit.* (see note 3, above).

composition (1814), devised the modern chemical symbols (1813), and developed (from 1811) an electrochemical ("dualistic") theory. He drew up tables of atomic weights. He discovered ceria (1803), isolated silicon (1810), titanium (1824), and zirconium (1825), and made detailed investigations of the compounds of tellurium (1834).[85]

Berzelius also discovered sarcolactic and pyruvic acids and many other organic compounds. He understood and named the process of catalysis. The recognition of isomerism in 1827 is also to his credit. Students flocked to his laboratory for instruction, many of whom afterwards became famous, Wöhler, H. and G. Rose, Sefström, Arfwedson, Gmelin, and Mitscherlich. In recognition of his work, he was raised to the rank of a nobleman in 1818, and in 1835, on the occasion of his marriage, to baron. Berzelius, because of his busy life, did not marry until he was fifty-six years old. His philosophy on marriage is interesting in view of the light it throws on his personality.

> Twenty-five years earlier, in view of the happy life of a foreign scientist, I had asked him whether on the basis of his experience it was right for an active and zealous scientist to marry. He had given me the following answer: If my question was meant to secure advice for myself, he could not advise me either for or against it. "However," he said, "although I am happy as only the father of a family can be, and the loss of my beloved wife would be a misfortune that I could hardly bear, yet I believe that if I were now unmarried, and had already had the experience with the cares of daily life that I now possess, I would certainly marry only if an unconquerable passion compelled me to do so." At that time this opinion influenced me to abandon forever all thought of marriage, and I later became firmly associated with this idea. Now I became undecided, I was not yet able to decide whether to forego this step. In this state of indecision I asked for advice from Count Trolle-Wachtmeister, an intimate friend and an experienced man of the world. "I presume," he answered, "that one can have a happy life without being married, but he who has not had the experience of a friendly home beside a beloved wife remains a stranger to the most beautiful aspect of life. With judicious choice it is not yet too late to have this experience. In order to really enjoy oneself one must have a *chez soi* and not have to seek it outside one's dwelling." This made up my mind.[86]

Even in his most private life, Berzelius was the cold, calculating chemist who must have all the facts before taking another step.

The stamp bearing the portrait of Berzelius was issued in commemoration of the 200th anniversary of the founding of the Royal Academy of Science at Stockholm (1939). Released in two denominations, a 10 ö. violet* and a 30 ö. ultramarine*, it bears the likeness of the oil painting by O. J. Sodermark who painted it in 1843, when Berzelius was sixty-four

[85] Partington, *op. cit.* (see note 33, above).

[86] *Ciba Symposia* 5 (1943) 1503; J. Berzelius, *Selbstbiographische Aufzeichnungen* (Leipzig 1903).

years of age. The full canvas shows Jöns Jacob Berzelius in full, seated in an armchair with his right arm resting on a table containing a balance and some books. He is wearing some of his decorations. The portrait was painted in recognition of the 25th anniversary of Berzelius as secretary of the Swedish Academy of Science.[87]

Carl von Linné (1707-1778), a contemporary of Scheele, was also honored in the same series with a 15 ö. fawn and a 50 ö. gray stamp bearing his likeness. Linné was a famous botanist and an organizer of natural science systems.

"There was born in Sweden in 1688 a man whose career is as baffling and perplexing to modern historians as it was to his contemporaries."[88] This man, Emanuel Swedberg (1688-1772), showed his genius while still a student at the University of Upsala. After graduating with honor, he traveled throughout Europe studying natural sciences. He continued his studies in science when he returned to Upsala. His many publications soon brought him royal recognition and he was appointed to the Swedish Board of Mines. The books he wrote on metallurgy mark an epoch in its history. Later when he was raised to the rank of nobility, he changed his name to Swedenborg. In his new position he soon became a powerful figure in the scientific society of Sweden. Although burdened with much state work, he continued to make prolonged visits to many mines in Sweden, Saxony, Bohemia, and Austria. We still use today many of the methods he described for refining ore. Swedenborg also studied much chemistry, etc. One is amazed at the versatility of the man. When in Several chemical works are known to be his, and although they contain much useless material they do show many ingenious deductions. He was one of the first to identify chemicals by their crystalline structure. What is today called the molecular magnetic theory is alluded to by this versatile Swede. He did not believe in the transmutation of base metals into gold. Although not familiar with the phlogiston theory, Swedenborg described a similar system. In 1734 he began to publish a series of books which was to sum up all human scientific knowledge. For this he combined all he could find on mathematics, astronomy, physics, geology, chemistry, etc. One is amazed at the versatility of the man. When in

[87] H. J. Soderbaum, *Jöns Jacob Berzelius Autobiographical Notes.* Translated by Olof Larsell (Baltimore, Williams and Wilkins Co., 1934).

[88] R. H. Major, *Faiths That Healed* (New York, D. Appleton Century Co., 1940).

later years he turned to theology and established the still extant Swedenborgian Church, he was too famous to disregard.[89]

On the 250th anniversary of the birth of Emanuel Swedberg (1938) Sweden isued a 10 ö. violet and a 100 ö. green stamp with an engraving after the portrait by Kroft.[90]

Russia's philatelic contributions to this study are indicative of the deep interest of the Soviet people in science. Since the revolution, appreciation of scientific accomplishment by the state has become strong. It is quite true that certain aspects of Marxist philosophy have stimulated such a condition, but it is also noteworthy that without strong government support it could not have flourished. Edwin Smith referred to this spirit after a recent visit to Russia to attend the 220th anniversary of the Academy of Sciences of the U. S. S. R.

> Through newspapers, special letters, and in a variety of ways, the importance of science and the achievements of science are being continually brought home to the Soviet people. Anyone who has been in the Soviet Union for any length of time cannot fail to be impressed by the fact that the Soviet government regards the development of science and its purpose as a fundamental fact in the life of their country and of great importance for all people.[91]

Langmuir, Shapley, Koethoff, and others have expressed like viewpoints.[92] The growth of Russian chemical literature in recent years has been amazing,[93] and can be traced in part to this state philosophy. Crane has stated that "it is reasonable to predict that Russia has permanently replaced Germany as the strongest European scientific contributor."[94] It is therefore not surprising to find that Russia has issued many stamps commemorating her men of science and in several cases her chemists. It was for their scientific achievements and not their political prestige that they were so honored. How different from many of the other countries that have been considered!

In 1925 Russia issued a stamp commemorating the second centenary of the founding of the Russian Academy of Sciences, a 3 k. orange brown* and a 15 k. dark olive green,* both containing a photogravure reproduction of the Academy and an oval insert of the head of Mikhail Vasilevich

[89] F. W. Avery, *An Epitome of Swedenborg's Science* (Boston 1927).

[90] Major, *op. cit.*

[91] E. Smith, *Science Bulletin, American-Soviet Science Society* 1 (1945) 5.

[92] *Ibid.* See also I. Langmuir, *Chem. Eng. News* 24 (1946) 759; and D. Masters and K. Way, eds., *One World or None* (New York, McGraw-Hill Book Co., 1946).

[93] E. J. Crane, *Chem. Eng. News* 22 (1944) 1478; J. G. Toplin, *Jour. Chem. Ed.* 21 (1944) 336; 23 (1946) 123.

[94] Crane, *Chem. Eng. News* 21 (1943) 1204.

Lomonosov, the first Russian professor of chemistry in the Academy of Sciences. Again in 1945 the Soviets honored the 220th year of the Academy by two more stamps, one a blue 30 k. with the Academy picture,* the other an olive green 2 r. issue* containing in addition a small insert of Lomonosov identical with the 1925 release. Menshutkin says of Lomonosov:

> A man of genius, a philosopher of many parts, he devoted his life to the pursuit of science—of chemistry, physics, mineralogy, geology, geography, astronomy, history, philology; to arts and technology and to the dissemination of knowledge in Russia.[95]

He was born in 1711 in Denisovka in the north of Russia, the son of an illiterate trader. Constant contact with people who came through the port sharpened his wit and made him eager for an education. Against the wishes of his father, who wanted his son to follow his own trade, the boy left home and went to Moscow, where by pretending nobility he was allowed to enter the Theological Academy. His brilliance soon put him ahead of his entire class. In 1735, because of his amazing scholastic record, he was sent by the Academy of Sciences in St. Petersburg to study in Germany. Here, under Christian Wolff at Marburg and Henckel at Freiberg, he received his foundations in philosophy, mathematics, physics, chemistry, and mechanics. When he returned to St. Petersburg six years later, he was appointed an adjunct of the Academy of Sciences, and in 1745 he was made its full professor of chemistry. It was here that he spent the rest of his life, amassing many honors. He died in 1765.

Lomonosov's work can be broken into two periods: one devoted to theoretical physical studies, the other to chemical investigations. His molecular theory, which was never published, is similar to that accepted today. He distinguished between molecules and atoms. It is amazing that he knew so much when modern chemistry was in its infancy. His studies of heat and the kinetic theory of gases were far in advance of his time. Lomonosov supported the wave theory of light and studied electrical phenomena extensively. The first university chemical laboratory in which students could work was built by Lomonosov in 1749. Here he presented one of the first courses ever given in physical chemistry. It was he who first designated chemistry as a science, and he was one of the few

* B. N. Menshutkin, *Jour. Chem. Ed.* 4 (1927) 1079. Boris N. Menshutkin (1874-1938) was a well known Russian chemist, best remembered for his monumental works on Lomonosov. See T. L. Davis, *Jour. Chem. Ed.* 15 (1938) 203 for a critical examination of his contributions to the history of chemistry.

chemists of his time to use quantitative methods in his research. Lomonosov rejected the phlogiston theory.

The portrait on the Russian postage stamps is from an oil painting made in 1752 when he was forty-one years old. There have been many reproductions of this portrait with minor modifications, but it is in all cases essentially the same as the painting by an unknown eighteenth century artist which hangs in Pushkin House of the Academy of Sciences of the U. S. S. R.[96]

The 1945 issue in honor of the 220th anniversary of the Academy of Sciences shows the Presidium of the Academy in Moscow. The Academy itself was planned by Peter the Great in 1718 with the aid of several German scholars, prominent among whom were Gottfried W. Leibnitz and Baron Wolff.[97] When Peter died in 1725, Catherine I, his widow continued his plans and the first meeting was held on December 27, 1725. Many German and Swiss scientists were appointed to the faculty. Peter first created the Academy because he felt that a powerful state was incomplete without some display of intellectual accomplishment. At first, the functions were honorary, but soon it began to publish many valuable works. In 1747 it was divided into the University and the Academy proper, but the former was afterwards dissolved. Under Peter II the Academy was forgotten and it was not until the reign of Anne that it again flourished. When Elizabeth reigned its scope was increased and for the first time native Russians assumed some of the chairs, Lomonosov among the first. Catherine II further stimulated its activities. Its contributions continued to increase in number and quality. After the revolution, the new state took it over, but it was some ten years before any radical changes were made in its structure. Today the Academy has some 136 academicians, 30 honorary academicians, and 224 corresponding members. More than 5000 scientific assistants are to be found in its 78 separate institutions which have a million-volume library at their disposal. The Academy has played a most important role in what Brasch terms "a new renaissance of Russian culture."

The second "Lomonosov" of Russia was Dmitrii Ivanovich Mendeleev.[98] Born in Siberia, he was the youngest child in a family of seven-

[96] A. Andreeva and L. B. Modzalevskii, eds., *Lomonosov, Collected Papers and Materials* (Moscow and Leningrad, Academy of Sciences, U. S. S. R., 1940).

[97] J. G. Crowther, *Soviet Science* (London 1936); F. E. Brasch, *Science* 99 (1944) 437.

[98] W. A. Tilden, *Famous Chemists—the Men and Their Work* (London 1921); Tilden, *op cit.* (see note 16, above).

teen. His father Ivan was the director of the Tobolsk gymnasium. His mother, Maria, was very fond of her last born, a feeling that never weakened. When the father became blind from cataracts, the mother heself supported the large family, since the government pension was inadequate. This she accomplished by operating a glass factory. Mendeleev showed early promise in the natural sciences, but a tragedy occurred which seemed to remove any chance for further schooling. His father died and the glass factory was destroyed by fire. However, his mother was determined that he should be educated, and, after many hardships, she succeeded in securing his admission to the Central Pedagogic Institute in St. Petersburg. Shortly afterwards, she died. Mendeleev never forgot his mother's sacrifices, which he later acknowledged in the preface to his volume on solutions.

> This investigation is dedicated to the memory of a mother by her youngest offspring. Conducting a factory, she could educate him only by her own work. She instructed by example, corrected with love, and in order to devote him to science she left Siberia with him, spending thus her last resources and strength. When dying she said, "Refrain from illusions, insist on work and not on words. Patiently search divine and scientific truth." She understood how often dialectical methods deceive, how much there is still to be learned, and how, with the aid of science without violence, with love and firmness, all superstition, untruth and error are removed, bringing in their stead the safety of discovered truth, freedom for further development, general welfare and inward happiness. Dmitrii Mendeleev regards as sacred a mother's dying words. October 1887.[99]

His work at the Institute was excellent. In 1859 he went to Paris to study with Regnault, and then to Heidelberg, where he carried on his own investigations. When he returned to St. Petersburg two years later, he received the doctorate and soon afterward was appointed professor of chemistry in the Technological Institute. In 1868 he attained the same chair in the University. In 1869 Mendeleev presented his paper on the periodic law, his greatest contribution to chemistry. This discovery enabled him to predict the properties of several undiscovered elements, some of which were found during his lifetime. He also made extensive studies of the thermal expansion of liquids. The *Principles of Chemistry* which he wrote is one of the great classics of chemistry. He also studied the oil fields of Russia and America, to which he made a trip to visit the Pennsylvania deposits.

Russia has remembered Mendeleev on two stamps which were issued in commemoration of the centenary of his birth, 1934. The first, in two

[99] Tilden, *op. cit.* (see note 16, above).

colors, a 5 k. emerald* and a 20 k. ultramarine*, shows a full seated statue of Mendeleev with a manuscript in his hand, and the usual clutter of books that was to be found in his office, around him. In the background is a modern version of the periodic table. The second stamp was also in two denominations, a 10 k. black brown and a 15 k. vermillion. It contains a full face portrait of Mendeleev which is after the work of the artist T. Anisimov who painted it in March 1932 for the sixth Mendeleev Congress held in Kharkov in the autumn of 1932.[100] The periodic table also serves as a background in this issue. The appearance of his hair on these stamps recalls the story related by Tilden.

> One of Mendeleev's most remarkable personal features was his flowing abundance of hair. The story goes that, before he was presented to the late Emperor, Alexander III, his Majesty was curious to know whether the professor would have his hair cut. This, however, was not done, and he appeared at court without passing under the hands of the barber. His habit was to cut his hair once a year in spring, before the warm weather set in. His eyes, though rather deep set, were bright blue, and to the end of his life retained their penetrating glance. Tall in stature, though with slightly stooping shoulders, his hands noticeable for their fine form and expressive gestures, the whole figure proclaimed the grand Russian of the province of Tver.[101]

Mendeleev enjoyed and appreciated art, but his tastes in literature were extreme. His secretary, Olga Ozarovskaya,

> was not a little struck to find such books as "Fiacre No. 113" and "The Fiery Lady" in his office. He was also very superstitious and never allowed any important work to begin on certain days. The number seven was his lucky number, but he avoided thirteen. How could this juxtaposition of science and superstition be explained? Let others try it. Perhaps it was his way of accounting for or indicating the limits of human knowledge. For he was very conscious of these limitations, he who knew so much and who even foretold so accurately some of the discoveries yet to be made.[102]

The fame of Mendeleev grew so great that his scientific titles filled an entire page of fine print.

The words of P. I. Walden best summarize the lives of the two most important Russians in the philatelic gallery.

> Involuntarily a comparison between the first Russian chemist, Lomonosov, and the greatest Russian chemist, Mendeleev, presents itself. The first can be called the

[100] P. V. Sletov and V. A. Sletova, "D. I. Mendeleev," *Zhurnal'no-Gazet. Ob'edinenie* (1933).

[101] *Op. cit.* (see note 16, above).

[102] O. E. Ozarovskaya, *D. I. Mendeleev in the Reminiscences of O. E. Ozarovskaya* (Moscow 1929); a small portion of this book is translated in W. R. Winicov, *Jour. Chem. Ed.* 14 (1937) 372.

Mendeleev of the eighteenth century. Both showed a striking similarity of character and genius. Both were physical chemists, giving their chief attention to the question of solutions. Both were philosophers, expounding their science from an elevated point of view; but both were practical men and patriots, striving with all their might to apply the science to practical purposes, for the good of their fatherland. Both were masters of word and style who endowed the Russian scientific language with new expressions and terms. By their work both were Titans, by the power of their scientific ideas, men, seeing clearly the future of science far ahead of their times.[103]

In 1925, Russia printed a stamp in commemoration of Alexander Stepanovich Papov (1859-1905), a Russian pioneer in radio and wireless telegraphy, 7 k. deep blue and 14 k. green. The "Biology Lesson" printed in 1938 is interesting for the picture it presents of children working in a laboratory. It is a 40 k. brown, a child welfare issue. Nikolai Chernyshevskii, a noted scientist and critic, has been honored on three releases, all bearing the same portrait (1939), 15 k. dark green, 30 k. dull violet, and 60 k. Prussian green. An interesting group of stamps are those of K. A. Timiryasev and the Academy of Agricultural Sciences. A 10 k. indigo shows the professor and the Academy building, a 15 k. has a picture of Timiryasev in his laboratory at Moscow University, a 30 k. dark violet brown stamp has his last portrait with a microscope to the left, and the last of the group, a 60 k. dark green reproduces a photograph of his monument in Moscow. All were issued in 1940 in commemoration of the twentieth anniversary of his death. Professor N. E. Zhukovskii of the military air academy has been honored by three stamps (1941), a 15 k. deep blue with his portrait, a 30 k. carmine rose with a picture of the Air Academy containing a portrait insert, and a 50 k. brown violet reproduction of Zhukovskii lecturing. In 1944, Russia commemorated the seventy-fifth anniversary of the birth of Sergei A. Chalplygen, scientist and mathematician, with two postage stamps, a 30 k. gray and a 1 r. light brown. One of the Soviet's most recent stamps is a 30 k. brown and a 1 r. greenish black (1945), both issued to honor the birth of Ilya I. Mechnikov, the zoologist and bacteriologist. After being professor of zoology and comparative anatomy at Odessa (1870) he went to Paris where he worked with Pasteur (1888). He succeeded Pasteur as Director of the Pasteur Institute in 1895. In 1908 he shared the Nobel prize with Paul Ehrlich for his work in physiology and medicine.

In turning from continental Europe to the United States and Great Britain, little is added to this review, for the English speaking world has

[103] Davis, *op. cit.* (see note 95, above).

honored few of its men of science on postage stamps. England and her many colonies have not issued one stamp bearing the portrait of her scientific men. She has rather kept to the traditional monarchy releases. This is disappointing, for Britain has many chemists who deserve a place in the file of philately. Charles Darwin, the English evolutionist, appeared on a stamp issued by Ecuador in 1936, a 20 c. dark violet. He is the only English scientist on a postage stamp.

America is not in a much better position, for though a few issues may be considered, they appear to honor the men for accomplishments other than those in chemistry. One of the first adhesive postage stamps issued bore the portrait of the illustrious scientist, Benjamin Franklin (1847). The Famous Americans commemorative series of 1940 included Charles W. Eliot among the educators. In the same series, but among the scientists, occurs the portrait of Crawford W. Long, of the anesthesia controversy. The inventors group contains no chemists.[104]

Though his career as a printer, publisher, almanac keeper, diplomat, signer of the Declaration of Independence, and member of the Constitutional Convention—not to mention his exploit with the kite, the key and the lightning bolt—are well known, too few, perhaps, appreciate that "Poor Richard", Benjamin Franklin, is the first name in American Science.[105]

So much has been written about Franklin's life and political career that little more need be said here. His active scientific work lasted only seven years in all, but in that time, among other discoveries he proposed the "one fluid" theory of electricity and proved that electricity and lightning are identical. Throughout his entire life, however, he pursued scientific interests, whenever his work was done.

Franklin was endowed with all the requisite qualities of a successful scientist; a desire for finding the truth at any cost, a natural inquisitiveness, logical and systematic methods of thinking and working, and a utilitarian point of view on scientific research.[106]

Cohen cites Carl Becker, the eminent American historian, on Franklin's love for science:

One activity which Franklin pursued without outward prompting, from some compelling inner impulse, one activity from which he never wished to retire, to

[104] *A Description of United States Postage Stamps* (Washington, United States Government Printing Office 1943). The scientist group consisted of stamps of John James Audubon, Luther Burbank, Walter Reed, and Jane Addams, in addition to Crawford W. Long. In the inventor series are Eli Whitney, Samuel F. B. Morse, Cyrus H. McCormick, Elias Howe, and Alexander Graham Bell.

[105] F. R. Moulton and J. J. Schifferes, *The Autobiography of Science* (New York, Doubleday, Doran and Co., 1945).

[106] C. J. Hylander, *American Scientists* (New York, Macmillan, 1935).

which he would willingly have devoted his life, to which he gladly turned in every odd day or hour of leisure, even in the midst of exacting duties and heavy responsibilities of his public career. Science was after all the one mistress to whom he gave himself without reserve and served neither from a sense of duty nor for any practical purpose.[107]

Benjamin Franklin organized the first scientific society in America, the Junto, in 1727. Later (1743) seeing the need for a larger society, he suggested the establishment of the American Philosophical Society. The Society was to meet once a month and discuss among other matters, the "new discoveries in chemistry," as well as "all philosophical experiments that let light into the nature of things, tend to increase the power of man over matter, and multiply the convenience or pleasures of life."[108] Franklin became its first president, a post he held until his death in 1790. He was one of the fellows chosen by the American Academy of Sciences. There were few early American scientific societies that did not claim him as a member. No doubt he would have also taken an active interest in the first chemical society, which was founded two years after his death (1792) by James Woodhouse.[109]

Franklin's interest in science was international. His many trips to Europe on governmental matters enabled him to meet the outstanding scientists of his day. Many societies sought his membership. When he returned to America, he would continue his friendships by letter. It is in this correspondence that the true extent of Franklin's work is to be found. It is here that many prominent chemists speak of their work. Jaffe has credited Franklin with building "the bridge which joined the worlds of science of two hemispheres."[110] Franklin studied chemistry with Winthrop and others, so that his knowledge in this field is not surprising. As in all his scientific endeavors, his interest in chemistry was in its utilization for man's betterment.[111] Among Franklin's associates were John Hadley, professor of chemistry at the University of Cambridge, [112] Musschenbroek and Cavendish,[113] Banks, Ingen-Housz, Priestley, Lavoisier, and others. The friendship of Benjamin Franklin and Joseph Priestley is a phase of chemical history that has been long

[107] I. B. Cohen, *Benjamin Franklin's Experiments—A New Edition of Franklin's Experiments and Observations on Electricity* (Cambridge, Mass., Harvard University Press, 1941).

[108] R. S. Bates, *Scientific Societies in the United States* (New York, John Wiley and Sons, 1945).

[109] E. F. Smith, *James Woodhouse; a Pioneer in Chemistry, 1770-1789* (Philadelphia 1918).

[110] B. Jaffe, *Men of Science in America. The Role of Science in the Growth of Our Country* (New York, Simon and Schuster, 1944).

[111] M. Curti, *The Growth of American Thought* (New York, Harper and Brothers, 1943).

[112] Jaffe, *op. cit.*

[113] C. Van Doren, *Benjamin Franklin* (New York, Garden City Publishing Co., 1941).

neglected. Priestley wrote his first scientific book, *The History and Present State of Electricity,* with Franklin's aid.[114] He owed his appointment as Shelburne's librarian to Franklin. When Priestley could not make up his mind whether to accept, Franklin wrote him a long letter explaining a mathematical method to solve such cases of indecision.[115] Various chemical concepts were discussed in their correspondence. It was Franklin's influence which later brought Priestley to America.[116] Priestley was a willing student in liberal political thinking, of which Franklin was a master. Many of Priestley's political writings can be traced to Franklin's influence.[117]

The letters of the two giants of science contain much wisdom. One of the most striking is a letter to Priestley (June 7, 1782).

> Men I find to be a sort of being very badly constructed, as they are generally more easily provoked than reconciled, more disposed to do mischief to each other than to make reparation, much more easily deceived than undeceived, and having more pride and even pleasure in killing than in begetting one another; for without a blush they assemble in great armies at noonday to destroy, and when they have killed as many as they can, they exaggerate the number to augment the fancied glory; but they creep into corners, or cover themselves with the darkness of night, when they mean to beget, as being ashamed of a virtuous action. A virtuous one it would be, and a vicious one the killing of them, if the species were really worth producing or preserving; but of this I begin to doubt.[118]

Klooster has briefly sketched the relationship of Franklin and Lavoisier.[119] The two worked very closely in chemical as well as in political matters. They were both members of a committee to study animal magnetism.[120] After Franklin's departure an extensive correspondence was continued for some years. He also wrote to Madame Lavoisier, who had made a portrait of him when he was in Paris. Several of the letters are important documents in the history of chemistry, since they brought the first news of many of the new concepts, which shook the foundations of chemistry, to this country. The esteem with which Franklin was regarded by Lavoisier is important to the chemical historian.

The first adhesive postage stamp issue of the United States, the series of 1847, bore a portrait of Benjamin Franklin. The picture of Franklin on this light brown 5 cent stamp is reproduced from a drawing by James B. Longacre. The series of 1851 contained a 1 cent indigo blue release

[114] W. C. Walker, *Isis* 21 (1934) 81.
[115] Van Doren, *op cit.*
[116] E. F. Smith, *Priestley in America* (Philadelphia 1920).
[117] D. W. Bronk, *Proc. Am. Philos. Soc.* 86 (1942) 103.
[118] Van Doren, *op. cit.*
[119] H. S. van Klooster, *Jour. Chem. Ed.* 23 (1946) 107.
[120] Van Doren, *op. cit.*

with a profile bust of Franklin. These stamps were the first ever issued in perforated sheets. A 30 cent orange and a 1 cent indigo blue on rose carrier stamp with a like portrait are to be found in this same set. The same bust is on many succeeding issues, 1861, 1869, 1870, 1873, 1884. The 1890 issue, a 1 cent blue, has another profile bust, after Ceracchi. In 1903 a 1 cent green stamp was issued bearing the portrait of Franklin which was painted by Joseph-Sifrède Duplessis when he was in Paris. Several later stamps have a profile bust based on the work of Houdon. A photograph of the Franklin statue by James Earle Fraser is found on the ½ cent orange issue of 1938.

To the already voluminous file on the ether controversy has been added a red 2 cent stamp bearing the portrait of Dr. Crawford W. Long. It was issued in Jefferson, Georgia on April 8, 1940.[121] Long is hailed in the South as the first man to use ether as an anesthetic. His life, and those of other claimants to this discovery, make a most interesting story, but they are beyond the scope of this paper. Several recent publications have evaluated his role fully.[122]

Charles W. Eliot (1834-1926), the well known educator and president of Harvard University, began his career as a chemist. Very few have ever heard of his work in chemistry. Born in Boston, he began his studies in Harvard University (1849).[123] His early chemical work was done in the laboratory of Josiah P. Cooke, Jr. Later Eliot recalled his student days.

> I was the first student whom he admitted to the little laboratory in the basement of University Hall. I therefore have a vivid recollection of the humbleness of the beginnings of both the chemical and mineralogical departments; of the elementary quality of the instruction given; and of the great disadvantages under which all instruction was given, without any possibility of offering laboratory practice to the students, except as a favor which could be granted only to very few.[124]

Under Cooke's guidance he studied chemistry for four years. After graduation he continued his chemical work for his Master's degree (1856), also assisting Cooke in his laboratory. After a few years as an instructor in mathematics and chemistry he was appointed assistant professor of chemistry at the Lawrence Scientific School. At this time he also began to publish joint papers on analytical chemistry with his brother-in-law,

[121] Jaffe, *op. cit.*

[122] V. Heines, *Jour. Chem. Ed.* 22 (1945) 428; T. E. Keys, *The History of Surgical Anesthesia* (New York, Schuman's, 1945); H. R. Raper, *Man Against Pain. The Epic of Anesthesia* (New York, Prentice-Hall, Inc., 1945); V. Robinson, *Victory Over Pain* (New York, Henry Schuman, Inc., 1946).

[123] L. C. Newell and T. L. Davis, "Notable New England Chemists," Program of the 76th A. C. S. Meeting, Swampscott, Mass., Sept. 10-15, 1928; L. C. Newell, *Ind. and Eng. Chem.* 16 (1924) 636; T. L. Davis, *Jour. Chem. Ed.* 6 (1929) 868.

[124] L. C. Newell, *Ind. and Eng. Chem.* 16 (1924) 636.

Frank H. Storer. On the expiration of his five year term as assistant professor, he decided to turn more of his attention to education.

> In the early summer I decided to stick to the profession of education, and the better to prepare myself for it, I resolved to spend two years in Europe, studying educational institutions and pursuing my studies in chemistry and technology.[125]

While abroad, he was offered the position of professor of chemistry and metallurgy in the Massachusetts Institute of Technology, which he accepted. Storer was also a member of this faculty. Together they began the chemistry department. They also prepared books for their classes, the now famous Eliot and Storer series.

> It is related that each of the authors maintained that the other's name ought to appear first on the title page. Discussion availed nothing, and it was agreed that a toss of a coin should decide the matter. The coin was tossed, Storer picked it up and announced that Eliot's name was to appear first. Eliot suggested that Storer had not looked at the coin, but Storer refused to admit the allegation—and the book came to be known as the Eliot and Storer. [On the title page of the books, the names of both are printed on the same line so neither will stand above the other.] . . . On the back of the binding of the first edition, the initials E. and S. are combined in a monogram in such manner that it is impossible to know which letter ought to be read first.[126]

Eliot continued to teach analytical chemistry and metallurgy for four years. He also published several papers on education. The ideas he proposed were so startling that he came to the attention of the Board of Overseers of Harvard University. On July 1, 1869 he resigned from M. I. T. to accept the presidency of Harvard, a position he occupied successfully for forty years.[127] He later acknowledged his debt to chemistry: "I recognize the fact that my early study and teaching of chemistry was a determining factor in my educational career."[128]

C. W. Eliot was honored for his educational accomplishments on March 28, 1940, by a 3 cent purple stamp bearing a left face profile portrait. It is said that he never showed his right side because of a scar from a chemical explosion.

With Eliot this chapter in the history of chemistry comes to a close. It has been shown that stamps and their meanings can pass far beyond the philatelic sphere. The appearance of more commemoratives makes this chapter a dynamic one. The issuance of chemist postage stamps should be fostered, for they contribute to the esteem of the history of chemistry by bringing its pioneers to the attention of all peoples.

[125] *Ibid.*

[126] T. L. Davis, *Jour. Chem. Ed.* 6 (1929) 868.

[127] The present president of Harvard, James Bryant Conant, is also a chemist.

[128] Davis, *op. cit.*

The Simultaneous Discovery of Rectal Anesthesia by Marc Dupuy and Nikolai Ivanovich Pirgoff

CURT PROSKAUER

WHEN IT was called to the attention of a German poet that his works bore a striking resemblance to those of a certain French writer, he wrote his critic: "We come across many such cases and yet there always remains something strange in the way two individuals of different nations can arrive at a like representation of nature while knowing nothing of each other."

Such coincidences occur, of course, not alone in poetry but in every field of endeavor. It is not generally known, however—at least no attention has been paid to the fact—that exactly one hundred years ago such a coincidence occurred in the medical world. The record of this strange case serves as an important contribution to the centenary of the historic public demonstration of ether narcosis by Morton on October 16, 1846.

Exactly five months after this memorable event, on March 16, 1847, at a session of the Académie Nationale de Médecine in Paris, a manuscript prepared by one Marc Dupuy, "interne des hôpitaux," entitled *Note sur les effets de l'injection de l'éther dans le rectum*[1] was read in the "Commission de l'éther."

> Ether inhalation has now been established as an accepted scientific method; the entire world recognizes its tremendous efficacy and the success achieved in its administration. Nonetheless certain facts demonstrate that in many cases it is not wholly harmless.
>
> Is there then some route whereby ether may be introduced into the body other than that usually followed hitherto? Only the stomach and the rectum can be considered. In the introduction of the ether through the stomach we must reckon with the disgust of the patient and resulting vomiting, which naturally make it impossible for the ether to act. In choosing the rectum, on the other hand, we avoid these disadvantages, and if the ether produces the same effects when thus introduced as when introduced through the lungs, much unpleasantness may be eliminated. We can learn the answer only through experience not yet gained. Inasmuch as I desired to study the situation, I performed experiments and submit herewith my results.

Here Marc Dupuy gives the details of his experiments on two dogs and closes his report with the words:

[1] *L'Union médicale* 1:34 (23 March 1847) 141; *Bulletin de l'académie nationale de médicine* 12 (1846-47) 458.

I should certainly never venture to draw final conclusions from my observations in these two experiments. *It has absolutely been established, however, that it is possible to produce insensitivity by the introduction of ether through the rectum.* True, this procedure may cause an irritation of the rectal mucosa, but is an inflammation of the rectum not far less dangerous than an inflammation of the lungs, which may occur when the ether is introduced into the body by way of the lungs?

Another question arises, whether it may not be possible to abate the unpleasantness connected with it by a *reduction of the quantity of ether* used? In my second experiment I employed a mixture of ether and water in equal parts, hoping thereby to attain this goal. Since I performed this experiment only yesterday, I do not yet know how it will develop. It is clear that further experiments are necessary. I intend to continue such experiments and vary them in every way possible, so that I may perhaps in this fashion arrive at a satisfactory result.

Three weeks later, on April 5, François Magendie laid before the "Commission de l'éther" of the Académie des Sciences in Paris this work of Marc Dupuy, somewhat further developed, since Dupuy wished to submit his findings for the consideration of this Académie also.

The ether commission, made up of members of the medical section of the Académie des Sciences, Professors François Magendie, Etienne Serres, Philibert Roux, Gabriel Andral, Alfred Velpeau, Claude Lallemand, as well as Arago, Marie Flourens, and Jean-Baptist Dumas, had been called into existence only a short while before. We get a good idea of its function and activities from an article in the *Union médicale* of April 10, 1847:[2]

The Academy of Sciences receiving so numerous reports on the properties of ether it was wisely decided to refer these reports to a commission whose duty it should be to study the question without engaging in discussions. Most of these reports seek to clarify the nature of the phenomena produced by the ether; efforts to interpret the state of intoxication achieved vie with efforts to interpret the accompanying asphyxial phenomena.

Let us permit them to adduce their arguments freely and let us be wise enough ourselves to wait until more prolonged observation and more numerous as well as more varied experiments enable us to take our position with regard to these theories with some degree of certainty.

The manuscript of Marc Dupuy which was submitted to the Académie des Sciences has been lost,[3] but according to the rather detailed official report on this session,[4] its content must have been much the same as that of his report to the Académie Nationale de Médecine with

[2] *L'Union médicale* 1:42 (10 April 1847) 179.

[3] When I inquired at the *Institut de France* for further records on Marc Dupuy, I was informed by the Secrétaire archiviste de l'Académie des Sciences that despite careful investigation nothing concerning the life and activity of Dupuy could be found in the archives or the library of the Institut and that the report of Dupuy was not on file.

[4] *Comptes rendus hebdomadaires des séances de l'Académie des Sciences* 24 (1847) 605-607.

the exception of a few additions, the later paper referring also to experiments on a third dog and on a rabbit, whereas the earlier report speaks only of experiments with two dogs.[5]

> I wished to satisfy myself whether it was not possible to introduce the ether into the body by another route than the lungs and thereby eliminate the drawbacks of this latter method. *Experiments which I performed* on three dogs and a rabbit *have proved to me that ether introduced through the rectum is absorbed very rapidly and produces total insensitivity.* . . . I believe I am warranted in stating that *this method can be employed with greater safety than the method involving the inhalation of the ether vapors.*

And now we have the strange fact that the very same idea of administering ether through the rectum—an idea quite novel at the time—was elsewhere being simultaneously conceived and tested by similar animal experiments and was even submitted for approval to the two Paris academies, all without the slightest knowledge of the Dupuy experiments and all in a part of the world so distant that no such knowledge was possible. At the April 27 session of the Académie Nationale de Médecine, exactly six weeks after the day on which Dupuy's report was presented, there was submitted a manuscript-letter written by the thirty-six-year-old Nikolai Ivanovich Pirogoff, "professeur de clinique chirurgicale à l'Académie impériale de chirurgie de Saint-Pétersbourg," a man already noted as a surgeon. The paper bore the title *Sur l'administration de la vapeur d'éther par le rectum.*[6] Eight days later the identical report was read again at a session of the ether commission of the Académie des Sciences, this time under the title *Nouveau procédé pour produire, au moyen de la vapeur d'éther, l'insensibilité chez les individus soumis à des opérations chirurgicales.*[7]

> This method [Pirogoff reports] consists of introducing the ether vapor through the rectum. My experience with animals has given me warrant to make use of this method even in surgical cases where the inhalation of the ether did not produce the slightest results. After cleansing the lower portion of the intestinal canal by means of a simple enema, I insert into the rectum an elastic catheter to whose other end I screw a syringe such as I normally use for blood transfusions. The syringe encloses a tin capsule filled with water warmed to 40° (Réaumur). Thanks to this arrangement, the liquid ether, drawn from a bottle into the syringe, immediately changes from its liquid form to vapor and in this form passes through the tube into the rectum. *The advantages of this method are quite obvious: The respiratory organs*

[5] It is clear from the report of the *Union médicale* 1:42 (10 April 1847) 181 on the session of April 5 that Dupuy can have made no substantial changes in preparing his later paper, since the report of the *Union médicale* limits itself to the statement "We have already [on the occasion of the discussion at the session of March 15] published the principal findings of this report [by Dupuy]."

[6] *Bull. de l'acad. nat. de méd.* 12 (1846-47) 591.

[7] *Comptes rendus* (see note 4) 24.789.

do not suffer in any way, the etherizing is entirely independent of the will of the patient and *works considerably faster;* after only two to four minutes the breath of the patient smells strongly of ether. *It seems to me that this method will completely supplant the pneumatic method, which is often very uncomfortable and disagreeable for the patients.* Operations which proved extremely difficult where the pneumatic method was used—as for instance a number of operations in the region of the face and the mouth, and especially operations on children—can now be performed very easily by my method. The quantity of ether found necessary in the cases I have observed so far was only 1.5 to 2 ounces and the narcosis was achieved in only three to five minutes. Thus far no unpleasant effects whatever have been produced.

After the report on the Pirogoff findings, the Secretary of the Académie des Sciences, Marie Flourens, Professor of Comparative Anatomy at the University of Paris, stated that he also had given animals ether infusions through the rectum to repeat the experiments "on which a young doctor" (he is referring, of course, to Marc Dupuy) "recently rendered a report to the Académie." Flourens explained that the results he obtained were nil, so that it was quite clear to him that the results of the original experiments had been incorrectly interpreted by Dupuy. Flourens' statements do not refer, however, and he makes special mention of this fact, to the method of Pirogoff, which, says Flourens, is not at all the same.[8]

And in fact the procedure followed by Dupuy at the beginning of his experimentation, viz. the introduction of the ether into the anus of the animals in pure form, had one great disadvantage: The bowels became greatly distended and the ether injected was quickly expelled. As has already been mentioned, however, this disadvantage was recognized at once by Dupuy himself, and even in his second series of experiments he avoided it by no longer using ether in pure form but mixing it in equal parts with water.

The idea of administering sulphuric ether vapor by means of enemas for anesthetic purposes must have spread throughout Europe very rapidly. As early as May 3, tremendous excitement was aroused by the announcement at a session of the Württembergische Ärztliche Verein that a sensational report of certain Russian doctors had appeared in a St. Petersburg newspaper concerning operations wherein the pain-deadening effects of ether had proved most powerful when the fumes were injected through the anus.[9]

Almost two months after Pirogoff's first report on his method of

[8] *L'Union médicale* 1:55 (11 May 1847) 230. 16:66 (21 August 1847) 527.
[9] *Allgemeine medicinische Central-Zeitung*

administering anesthesia through the rectum, on June 21, 1847, the Académie des Sciences heard the paper of Pirogoff which accompanied his book *Recherches pratiques et physiologiques sur l'éthérisation,* just published by F. Bellizard & Cie in St. Petersburg. This paper contained a report on the confirmed successes he had achieved with rectal narcosis since he had finished the manuscript of his book.[10]

Since the book treats of the practical and physiological research done in ether narcosis, it naturally discusses rectal anesthesia in greater detail than does the first report to the Parisian academies. Pirogoff states that very shortly after the entrance of the ether fumes into the rectum, the sigmoid flexure is distended and pulse and respiration are accelerated. Normally the patients fall gently and fast asleep in one or two minutes and remain in this condition even after the apparatus has been removed, longer, in fact, than when the ether is introduced through the lungs. The voluntary muscles very quickly relax completely, whereas the contraction of the involuntary muscles continues uninterrupted. The bowels soon expel a lot of wind mixed with ether fumes and often stools. No irritation of the lungs occur and the condition of the patient after the operation shows absolutely no unfavorable effects that can in any way be laid to the administration of the ether. In only three of forty major operations performed by Pirogoff with this method of anesthesia did he fail to achieve desensitization.[11]

In connection with a report on this session of the Académie, *The Medical Times* writes:[12]

> The success obtained by M. Pirogoff in the application of his method having reached the ears of the Emperor of Russia, his Majesty has sent M. Pirogoff to the Caucasian army, in order that the benefit of ethereal injections may be extended to those who undergo operations in consequence of wounds inflicted on the field of battle.

Pirogoff's successes with his rectal anesthesia reached the ears not only of the Russian Czar but of the entire medical world. The idea of rectal anesthesia was from then on most closely associated with his name.

It was natural enough that the noted surgeon of the capital of the Russian Empire, with its great hospitals, should not rest content with

[10] *Comptes rendus* (see note 4) 24.1110.

[11] *Literarische Beilage zur medicinischen Zeitung* 32 (11 August 1847) 157-58. (Review by Lichtenstädt.)

[12] *The Medical Times: A Journal of English and Foreign Medicine, and Miscellany of Medical Affairs* 16 (3 July 1847) 373.

his physiological animal experiments but should make practical application of the results obtained therefrom in his operative work.

"The young doctor" Dupuy, "interne des hôpitaux," unknown then and still unknown, certainly did not enjoy Pirogoff's opportunities. He was obliged to make the most of his experiments on three dogs and a rabbit—carried through with extraordinary ingenuity—and content himself with stating his well-warranted conviction based on his animal experiments "that it is possible to produce insensitivity by the introduction of ether through the rectum and that he had good grounds for maintaining that this method could be employed with greater safety than the method whereby the ether vapors are inhaled."

Dupuy wrote these words exactly six weeks before Pirogoff submitted his precisely similar method for the consideration of the Académie.

Marc Dupuy did not, however, follow in the footsteps of the many who have battled for priority in the field of anesthesia. Dupuy remained silent, so completely silent that no biographical lexicon has anything to say concerning his life or achievements.[13] We know only that he never was a member of the Académie des Sciences, as that institution has informed me.

In a quite different connection, Sir Humphry Davy Rolleston makes the remark:[14]

> It often happens that the same ideas occur to several minds at the same time but that simultaneous and identical solutions are not published synchronously, thus making it far from easy to decide who really deserves the rather barren crown of priority.

[13] In consequence of a series of unlucky circumstances, posterity has involuntarily done its best to efface the name of Marc Dupuy and consign it to oblivion. Walter S. Sutton in the chapter on "Anesthesia by Colonic Absorption of Ether and Oil-Ether Colonic Anesthesia" in J. T. Gwathmey's *Anesthesia* (2nd ed., New York and London 1924, p. 434) inadvertently spelled the name "Duprey." Sutton, in a footnote, gives as his source: "Académie royale de médecine, March 16, 1847," wherein the name of Dupuy is correctly written. In *The History of Surgical Anesthesia* (New York, Schuman's, 1945, p. 45), Thomas E. Keys takes over this misspelling, citing Gwathmey as his source, so that Dupuy's name appears in neither of the two standard works on anesthesia. In Fulton-Stanton's excellent catagolue *The Centennial of Surgical Anesthesia* (New York 1946, p. 85, no. 110 and p. 101), the name of Dupuy does not appear under "Dupuy" but under "Marc-Dupuy" thanks to an error in the official report of the session of the Académie des Sciences (*Comptes Kendus,* see note 4, 24 [5 April 1847] 605), where the forename "Marc" is separated from the surname "Dupuy" by a hyphen.

[14] *Cardio-Vascular Diseases since Harvey's Discovery. The Harveian Oration Delivered before The Royal College of Physicians of London on October 18, 1928* (Cambridge 1928) 3.

Notes and Queries

Edited by RALPH H. MAJOR

Durities in Renibus

IT HAS BEEN rather widely accepted that William de Saliceto (1210-1280) left the first original account of chronic nephritis in his well-known description of "durities in renibus." However, Rufus of Ephesus, 1000 years before Saliceto, wrote of "sclerosis of the kidneys" (*περὶ σκληρίας νεφρῶν*) in a fragment preserved by Oribasius. A Latin manuscript of Oribasius' *Synopsis,* which contains practically the same description, carries the title "Ad renum duritias."

The pertinent extract from Saliceto is as follows:

> The signs of hardness in the kidneys are that the quantity of the urine is diminished, that there is heaviness of the kidneys, and of the spine with some pain: and the belly begins to swell up after a time and dropsy is produced the second day: and thus such hardness is produced after a warm abscess in the kidneys and after fever of them.

The following is translated from the French of Bussemaker and Ch. Daremberg after comparison with the Greek text. We have employed the word "induration" in translation of the French "induration," although it would be equally accurate to employ "sclerosis," which would correspond to the Greek "*σκληρίας*."

> Induration which develops in the kidneys causes no pain, but it seems to the patients as if a weight were hanging from their body in the region of the flanks; they note a numbness about the hips, weakness of the legs, scanty urination, the condition of the body resembling most closely a dropsy. In this condition one should soften the kidneys with cataplasms and massage, administer substances which increase the urine and soften the abdomen with enemata.[1]

Aetius of Amida also wrote of chronic kidney diseases. In the chapter "De duricie renum" we find the following:

> Whenever sclerosis arises about the kidneys, it does not cause pain but it seems to the patient as if something hung from around the stomach, numbness attacks the hips, there is weakness of the legs and they urinate little, the rest of the body appears much like in those suffering from water in the skin. Further, in time they develop obvious hydrops as if spreading from the other hardened viscera.[2]

"De duricie renum" is Chapter XVII. The preceding chapter "De renum inflammatione" is taken from Rufus. Aetius was obviously familiar with the writings of Rufus and doubtless with his chapter on sclerosis of the kidneys.

[1] *Oeuvres d'Oribase.* Traduit par Bussemaker et Ch. Daremberg (Paris, Imprimerie Nationale, 1873) V. 514.

[2] *Aetii Amideni medici clarissimi libri sexdecim.* Translation of Johannis Baptista Montano, *Iano Cornario Zuiccaviensi interprete* (Venice, Junta, 1534) 185.

Among the other remarkable passages which Oribasius has preserved of Rufus is one which refers to the favorable effect of fever in certain diseases. Rufus writes:

> I think then that you would not be able to find any other medicine which warms in a more penetrating manner than fever. This is very good for convulsions, for a patient stiffened by tetanus as well as for a pregnant woman, the prey of convulsions. And if there lived a physician clever enough to be able to produce a fever, it would be useless to seek any other remedy against a disease.

In summary, the conception of hardening of the kidneys with scanty urination and dropsy was not original with William de Saliceto. Rufus (*c.* 100 A.D.) was familiar with the picture and described it; Aetius of Amida (502-575) four centuries later described it, probably utilizing the knowledge of Rufus; seven centuries after Aetius, William de Saliceto (1201-1277) wrote of hardening of the kidneys, pointing out the same outstanding features as noted earlier by Rufus and Aetius.

RALPH H. MAJOR

Some Medical Chronograms

By-products of the recent shelflisting of books in the History of Medicine Division of the Army Medical Library have been many and interesting. Among them is the discovery of a number of fine chronograms. While these fascinating date ciphers themselves are of ancient lineage, the name now used is apparently of sixteenth century origin. "The words Chronograph, Chronicon, Chronostichon, Eteostichon, Eteomenehemerodistichon, and some other kindred words, are synonymous, and are used indiscriminately by early writers. The word Chronogram is said to have been first used in some verses addressed to the King of Poland in 1575."[3] The cipher is formed by capitalizing the Roman numeral letters in a phrase to make them stand out. When the values of all such letters in the phrase are set down and added together, the sum will be a date, usually of the Christian era, and ordinarily having some connection with the matter of the book in which it is found. Most chronograms are in Latin, but they may be made in any language which uses the Roman alphabet.

True to type, our medical number-puzzles are usually expressed in Latin, but some in German have been noted; probably others in still other languages have escaped attention. It seems also to be true of these chronograms, as W. H. White has said of the species in general, that "the most prolific soils were the States of the Empire, i. e. Austria, Bavaria, Bohemia, and the Netherlands, and the most fruitful periods were the seventeenth and eighteenth centuries."[4] At

[3] James Hilton, *Chronograms, 5000 and More in Number Excerpted out of Various Authors and Collected at Many Places* (London, Elliot Stock, 1882), Preface, p. [v]. Most of Hilton's examples were taken from inscriptions in churches or other public buildings, from gravestones and monuments, or from coins and medals, though some were from books. He found very few English chronograms.

[4] W. H. White, "Chronograms," *The Library; A Quarterly Review of Bibliography,* Fourth Series, 4 (1924) 63. (Transactions of the Bibliographical Society, Second Series, Volume 4.)

least, all those so far located in this collection are from the region and period mentioned.

The following list is representative:

I. CHRONOGRAMS ON TITLE-PAGE

1. Brathwaite, Richard, Jus potandi, oder Zech Recht . . . durch Blasium Multibibum pseud. . . .
sumptibus authoris / Anno / est Mea CVra DeVs [1610].
At bottom of title-page: Anno/ Der hIrsch woLL aVsseM /brVunne sprVng.
2. Brückmann, F. E., Ausführliche Beschreibung einer seltsahmen Wunder-Geburt . . . Wolffenbüttel, Johann Christoph Meiszner . . . See illus.
3. Dissertationes de laudibus et effectibus podagrae . . . [n. p., 1715].
Title covers two leaves, chronogram on verso of 2d leaf: In / Mense / sIbI sVIsqVe / DoLorose / heteroCLIto.
4. Kirsten, Petrus, Liber de vero usu et abusu medicinae . . . Breslae / . . .
5. Lacrumae aeternae a singularibus amicis, pietate, doctrina et virtute ornatissimis, in obitum magni incomparabilis, et per totum orbem terrarum notiss. venerandisenis Dn. Guilhelmi Fabrici Hildani . . . Arcotopoli / anno / eXpergIsCIMInI IVDeX orbIs VenIt [1637].
6. Lodgman von Auen, Johann Rudolph, In VentI neo fontIs aqVas / VIrtVte saLVbrIs, / sanCt-annaeVs ager Mo- / DLetInensIs habet. / Das ist: Neü erfundenes Wasser Sanct Annae genannt . . . Kuttenberg, Georg Adalbert Kintzl, 1738.
7. Lyseck, Joannes Philippus de, Propugnaculum contra pestem; oder, Vorbaw wider die Pestilenz . . . aVs neVV poLItIsCher / spraCh In DIe aLt leVtsChe Versetzt / Von / Joann phILIpp De LIJseCk / AEtatIs sVae XXVIIII. / . . . / Straubing, bey Johann Chrysostomus Haan [1674]. Note: The AE in *aetatis* is printed in capitals on the title-page, but is not part of the chronogram, which is therefore imperfect.
8. Mannagetta, Joannes Guilielmus, Pest-Ordnung . . . Anno / pestIs VIennae se Vere grassantIs, & pLVrIMos non aVDIta / strage InterfICIentIs. / Aufbegehren wegen mangel der Exemplarien, /zum andern mal /aufgeleget und nachgedruckt. Im Jahr Christi, 1680. Note: Chronogram totals to 1679.
9. Muralt, Johann von, Vade mecum anatomicum, sive clavis medicinae . . . Tiguri / Anno, quo fulgere coepit / LVX et faX MeDICInae. / typis Davidis Gessneri [1677].
10. Queccius, Gregorius, Anatomiae philologicae, pars prima . . . Noribergae, typis & sumptibus Simonis Halbmayeri, anno / DIVInae sapIentIae Ista VoX est: nosCe- / sIsteIpsVM [1632].
11. Sorbait, Paulus de, Praxios medicae . . . Viennae Austriae, apud Leopoldum Voigt . . .
Title-page printed in black and red; imprint in red; chronogram immediately above imprint, numeral letters in red, others in black: Anno / qVo Venenata LVes, Deo Dante & faVente, eX toto CeDebat.
12. Tschiaska von Sternstein, Ferdinand, Kurtze Beschreibung desz heylsamben Swataniowitzer-Bads . . . König-Gratz, bey Wentzl Johann Tibelli.
Chronogram immediately above imprint: In Iahr / aLs / ZwIschen aDLer VnD LILIen / ne Ver SrIeDt War.

13. Tudecius, Simon, O. A. M. D. G. Amussis antiloimica ad mentem quorundam clarissimorum archiatrorum tum veterum tum recentiorum in arte peritorum concinnata, & practice adhibita:
Anno quo / LVgVbrI sVo raDIo VIsVs est astra Infestare / CoMeta. / Nunc demum / grassantIbVs MaLIgnIs febrIbVs & peteChIIs / In trIVrbe faVente Deo a VarIIs eXperta / . . .
Norimbergae, expensis Johannis Ziegeri, 1695.

II. CHRONOGRAMS ELSEWHERE THAN ON TITLE-PAGE

1. Fasciculus variarum resolutionum de officio et obligatione parochi et modo administrandi sacramenta tempore pestis . . . Eystadii, F. Strauss, 1714.
Chronogram at end of text (verso of folio 166): tIbI Deo trIno sIt LaVs / seMper per saeCVLa.
2. Hornung, Johannes, Cista medica . . . Noribergae, sumptibus Simonis Halbmayri [1625].
Chronogram at end of "Dedicatio" (verso of folio [4]):
JVstIfICaMVr fIDe absqVe operIbVs.
3. Lodgman von Auen, Johann Rudolph, Uhraltes Heyl-Baad S. Joannis . . . Prag, Leopold Grim, 1747.
Chronogram at end of "Das erste Capitel" (verso of folio A 5): aegrotIs Moras fert / eX hoC fonte saLVtIs. / proDIgIsos fons Iste / saLVtIs aqVas.
4. Ludwig de Libeneck, Franciscus Caspar, Anchora salutis, seu disquisitiones medicae . . . [Vetero-Pragae, haeredes Labaunianorum, 1725].
Chronogram at the beginning of each disquisition, like the following (p. 7): Disquisitio I./ In qua / orIgo saLVtarIs, & qVID- / DItas CLare sVppeDI- / tatVr.
5. Noscomium infantile, et puerile; das ist, KinderLazaret . . . verfertiget durch Casparum Amthor . . . Schleusingen, Gedruckt durch Peter Schmiden, 1638.
Chronogram at end of text: VVeIL eIn kLVger ChrIstMVsz gantz stoCk / stILLsChVVeIgen; Ist eIn reChte böse zeIt.
Army Medical Library, Cleveland, Ohio JEANETTE BEEBE

A Medical Painting by Toulouse-Lautrec

Henri de Toulouse-Lautrec died in 1901 at the age of 37. Small, ugly, and misshapen, he had devoted his life to painting and the graphic arts. He was the painter of the Paris demi-monde, of circuses, bars, theaters, and horse races. It is not generally known, however, that he also produced several pictures with medical themes. One of these, the so-called *Opération de trachéotomie* is reproduced here.

This painting shows the famous French surgeon Jules Péan (1830-1898) performing an operation, which is apparently not a tracheotomy but rather some procedure involving the pharynx or the mouth. Although Péan was never professor at the medical school in Paris, his service at the Hôpital Saint-Louis was a teaching center to which students flocked. A tall man, he dominated his assistants by his stature, and operated in a frock coat, a napkin tucked around his neck, and his sleeves barely pushed back. Yet it is said that he hardly bloodied his hands.

F. E. Brückmanns, M. D.

Ausführliche Beschreibung Einer seltsahmen Wunder-Geburt,

Welche

Eines abgedanckten Soldaten-Frau den 23. Febr. in Wolffenbüttel zur Welt gebracht.

sI rarI partVs pLenè DIgnosCIMVs artVs,

eXterIora patent, InterIora Latent.

cum Fig.

Wolffenbüttel,
Zu finden bey Johann Christoph Meißner,
Hertzogl. gnädigst privil. Buchhändler.

Opération de trachéotomie

In 1891, Toulouse-Lautrec frequently accompanied his cousin, Dr. Tapie de Céleyran to the hospital, and made several sketches of Péan operating. Péan is shown in his habitual costume, and is portrayed with great vigor.

GEORGE ROSEN

Mediaeval and Renaissance Latin Translations and Commentaries

Under the auspices of the Committee on Renaissance Studies of the American Council of Learned Societies, of the American Philological Association, and of the Mediaeval Acadamy of America, a group of scholars has begun work on a List of Mediaeval and Renaissance Latin Translations from the Greek, and of Mediaeval and Renaissance Latin Commentaries on Greek and Latin authors who wrote before 600 A.D.

The aim is to assemble pertinent data from both printed and manuscript sources. The work, when completed, will illustrate the history of classical scholarship in the Middle Ages and the Renaissance, and the fortune of individual ancient authors during those periods.

The following scholars are members of the Editorial Board:

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Inquiries regarding the project may be directed to any editor in the above list.

Book Reviews

Studies and Essays in the History of Science and Learning Offered in Homage to George Sarton on the Occasion of his Sixtieth Birthday, 31 August 1944. Edited by M. F. Ashley Montagu. New York: Henry Schuman, 1946. xiv+597 pp., illustrated. $12.00.

THE APPEARANCE of a Festschrift in honor of a scholar is always an occasion of gratification. The appearance of the present volume is that and far more. It has an importance and significance which transcend the occasion—the celebration of Dr. Sarton's sixtieth birthday—and thus proves itself most worthy of the occasion.

When Dr. Sarton came to this country in 1915, work in the history of science was for the most part casual and sporadic, and was too often the mere by-product of the antiquarian curiosity of specialists in other fields. One can hardly exaggerate Dr. Sarton's influence in raising the standards of scholarship in this field of study and in revitalizing and enriching its scope.

His writings and teachings have borne fruit. Certainly the academic world is paying increased attention to the history of science, and in so doing is at last beginning to fulfil a very real need of our times. The tremendous increase in specialized knowledge in the last centuries brought in its wake an increasingly sharp cleavage not only between scientific and humanistic education, but between the various branches of science itself. In the history of science, however, educators have a powerful unifying instrument, which they are now beginning to use, to offset these divisive influences.

And in the teaching of science itself the recent tendency has been to emphasize the interrelations of the various branches and the essential unity that underlies them all.

These are developments which Dr. Sarton has long been championing. If they are carried forward vigorously, scientists and humanists will once more be able to meet on common ground and cooperate in understanding the past and the present of man's civilization. And among the scientists themselves there will perhaps be a greater readiness, when problems require it, to emerge from the parochial boundaries of their special fields and to cooperate in envisioning and pursuing lines of research which cut across these barriers.

But to return to the history of science. Dr. Sarton has always taken the broadest possible view of his subject, the story of man's cumulative acquisition of systematized positive knowledge. He has always held that the mutual impacts of science and philosophy, of science and art, of science and religion,

of science and society, must be examined in order that the story of man's scientific achievement may be more than a mere chronology, may indeed be a central theme of the history of civilization.

The essays now published in his honor give us an excellent example of that breadth, variety, and richness of affiliation which mark his own conception of the study of the history of science. They are in that sense a most worthy tribute.

The volume contains 27 papers. Though some of them cannot be justly classified under a single head, we may say that of the 27, five deal predominantly with biology and medicine, four with mathematics, four with astronomy, four with the humanistic, cultural, and ethical relations of science, three with the philosophy or methodology of science, two with political and social science, and one each with cosmogony, technology, cartography, linguistics, and comparative religion.

A critical estimate of the papers should be left to the specialists in the several fields, and is in any case far beyond my own competence. I think it well nevertheless briefly to indicate the contents.

Biology and Medicine. John B. de C. M. Saunders and Charles D. O'Malley translate Vesalius' letter of 1539 on bloodletting. In an introduction they discuss the history of therapeutic bloodletting with special reference to the controversy in the sixteenth century. The letter itself reveals Vesalius' characteristic insistence on observation as opposed to mere literary authority. Quite apart from the scientific details, the general reader will find interest in the spirit and personalities of the controversy, and in the reflection, which the letter affords, of the climate of intellectual and professional activity in the sixteenth century.

Charles Singer, writing on Vesalius' philosophic background, emphasizes his dependence on Galen and his adherence to the teleological viewpoint. The paper is a welcome corrective to the view, so often encountered, which stresses Vesalius' contradictions of specific details in Galen. Yet Dr. Singer himself, who knows the work of the ancients so well, seems to me to err in saying of Vesalius' *Fabrica,* "it introduces observational science."

F. J. Cole translates the account by Dr. William Croone (1633-1684) of the development of the chick, an important document in the controversy on preformation and epigenesis. Croone actually claimed (and gained some support for his view) that a complete microscopic fetus appeared before incubation, indeed before fertilization!

Richard H. Shryock considers the question why William Wells, who as early as 1813, half a century before Darwin, had formulated in essence the theory of natural selection, received so little recognition. Dr. Shryock discusses

the dissemination of scientific ideas in general and suggests that in Wells' case a major impediment to effectiveness was the manner of presentation, the hypothesis being set forth incidentally and almost apologetically in the course of a paper itself unlikely to attract the attention of those interested in biological evolution. Questions of this kind make it abundantly clear that the history of science is something more than the sum of histories of the sciences.

Conway Zirkle writes on the discovery of what is now called sex-influenced, sex-limited, and sex-linked heredity. He summarizes the developments down to the present, and presents an extensive bibliography of the subject.

Mathematics and Astronomy. Solomon Gandz compares the level of civilization in general, and of mathematical achievement in particular, attained in Babylonia and Egypt in pre-Greek times. In both comparisons the level attained in Babylonia is in most respects found to be higher.

Otto Neugebauer takes up the question when the 19-year cycle was first used as a basis of determining the intercalation of months in the Babylonian calendar. He adduces new evidence that this practice may date from as early as 480 B.C., rather than a hundred years later, as has generally been held. Since Meton's announcement of the 19-year cycle was made in 432 B. C., the question discussed in the paper obviously has large implications for the understanding of the relations between Greek and Babylonian astronomy.

J. Ma Millás Vallicrosa investigates an astronomical almanac found in two medieval Latin manuscripts. He holds that it is probably a translation of a work originally by Rabbi Abraham Ibn Ezra.

Lynn Thorndike discusses a treatise on comets by Aegidius (Gilles) de Lessines, a work inspired by the appearance of a comet in 1264. Of particular interest are the precise details recorded about this comet and the scope of the literature, ancient and contemporary, cited by Aegidius. Dr. Thorndike intends before long to edit the complete text of the treatise.

Dorothea Waley Singer calls attention to an unusual plan of the universe depicted in two manuscripts of the late fifteenth or early sixteenth century. The conception is essentially heliocentric.

H. Gwyndedd Green writes of the mathematical physicist George Green (1793-1841). The author's chief concern is to record data about Green's life apart from his scientific work, which is dealt with only incidentally. It is interesting to note that George Green entered Cambridge when he was 40 (though he had published his great paper on electricity and magnetism five years before) and received his bachelor's degree at 45, three years before his death.

Raymond C. Archibald adduces some new material on the life of the mathematician James Joseph Sylvester and publishes for the first time a portrait of him (age 26) and two photographs (ages 55 and 70). The new data serve as addenda to an article by Dr. Archibald (*Osiris,* 1936) on the same subject.

Paul Schrecker finds in the works of Wallis, Malebranche, Fontenelle, and others, material that significantly foreshadowed the ideas of George Cantor on transfinite numbers. Ideas on the infinitude of orders of infinity and on the relations among them are found in the seventeenth and eighteenth centuries but have to await clarification until the nineteenth. As in so many other papers of this volume the relation of the sciences to the humanities and philosophy stands in the foreground.

Cultural and Ethical Relations of Science. M. F. Ashley Montagu makes a strong plea for the teaching of the history of science and for the teaching of science as one of the humanities, with emphasis not on technics but on the place of science in the whole cultural picture. By way of illustration the early volumes of the Transactions of the Royal Society are commended to teachers of seventeenth century literature seeking to learn and expound the ideas of the period.

Grant McColley discusses literary aspects of controversies about the earth's diurnal rotation and about the various astronomical systems. These controversies sharpened the impact of conflicting theological and scientific ideas on poetry and other non-scientific literature. Here is a theme exactly in line with what was advocated in Dr. Montagu's paper.

Harcourt Brown discusses Buffon's contacts with British scientists and in this connection throws light on cultural relations between England and France in the eighteenth century.

Chauncey D. Leake describes a first attempt by a group of scientists to establish a system of ethics based on scientific knowledge and expressed in scientific terms.

Philosophy and Methodology of Science. Agnes Arber traces by copious examples the use and abuse of analogy in science. An excellent instrument for suggesting hypotheses and for illustrating and illuminating scientific exposition, analogy loses its meaning when overpressed and used as "proof."

In a brilliant essay, among the last things he wrote before death ended his distinguished philosophical career two years ago, Ernst Cassirer takes up the much discussed question whether Galileo was a Platonist. To be sure Galileo did not follow Plato in distinguishing between the real and the sensible world. But despite this difference in metaphysical viewpoint, Cassirer shows that in his emphasis on mathematics and deduction, in his treatment of hypotheses, and his analysis of problems, Galileo was a kindred spirit of Plato, Eudoxus, and Euclid.

Victor F. Lenzen discusses Helmholtz's views on space, number, measurement, causality, and perception as aspects of that scientist's general theory of knowledge.

In Other Categories. J. Delevsky reviews the history of the conflict between the idea of cyclical repetition in the universe and the idea of unidirectional and irreversible devolution. He suggests that simple ideas such as these are inadequate to describe a complex universe in which there may be partial repetitions (though not absolutely identical "eternal returns"), and yet room for infinite novelty.

Ananda K. Coomaraswamy examines from the viewpoint of comparative mythology and religion the idea of Clashing Rocks (Symplegades) and its many analogues (floating islands, cutting reeds, active door, divided sea, etc.) found throughout the world. The conception, according to the author, basically signifies a gateway to liberation from the conflicts and polarities of the mortal world, to a world without conflict, the hereafter.

James R. Ware takes up the difficulties surrounding any attempt to formulate a Chinese grammar, and in particular discusses Henri Maspero's writings on the subject.

Aubrey Diller investigates the maps made of the Missouri River before the expedition of Lewis and Clark (1804-1806), among them the maps of Mackay and Evans (1795-1797). Diller's work indicates that for the lower part of the Missouri the contribution of Lewis and Clark themselves has been generally overrated.

Bern Dibner examines the writings and drawing of Leonardo da Vinci on various aspects of military engineering. Eighteen of the drawings are reproduced, full-page, to illustrate the text.

Giorgio de Santillana writes on positivism and technocracy in the nineteenth century. Sketching the development from Descartes through the eighteenth century to Saint-Simon, Fourier, Comte, and their followers, he shows how the technocratic ideal involved fundamental philosophic contradictions and could pass from rationality to irrationality, from an instrument of emancipation to one of totalitarianism.

Robert K. Merton holds that the role of intellectuals in public bureaucracy merits broad consideration. He contributes a preliminary discussion of the theme, calling attention in particular to the part played by intellectuals in policy making, and to the types of psychological problem found among intellectuals in public service.

Such then is the rich and varied fare that is spread before us. The papers are preceded by a brief biography of Dr. Sarton contributed by his daughter, Miss May Sarton. The volume closes with a poem by Miss Sarton in honor of her father, a plea for a living scholarship, zealous and militant for truth, as opposed to a lifeless pedantry withering in detachment.

Those who cooperated to bring out this volume as a tribute to a distin-

guished teacher and scholar have indeed earned the gratitude of all who cherish true scholarship.

College of the City of New York I. E. Drabkin

Douglas Guthrie. *A History of Medicine*. With an Introduction by Samuel C. Harvey. 448 pp., illustrated. Philadelphia: J. B. Lippincott Co., 1946. $6.00.

It is perhaps becoming trite to assert that interest in the historical and cultural aspects of medicine and science is growing in the United States and in British countries, localities that in the past have seemed to lag behind those in Europe. Yet such seems to be the case, as the foundation of this Journal in which this review appears and the increased number of books and monographs seem to testify. General texts in English on the history of medicine have been surprisingly few—partly explained, no doubt, by the excellence of the four editions of Garrison's *Introduction*.

Guthrie's book, therefore, is a welcome contribution, and especially so because of the happy style that we so often find even in the scientific writing of our British colleagues. Though it is a small book for such a subject, the topics selected for inclusion are approached in a leisurely way, with frequent interweaving of fresh and piquant items, so that the book is a pleasure to read. This, of course, inevitably still further limits the comprehensiveness of the treatment, as may be seen by comparing the 2500 odd items in the single index with about 11,000 in Garrison's two indexes; but comprehensiveness was not Dr. Guthrie's aim. He has, as he indicates, constructed an outline of the progress of medicine from Imhotep to Osler, in which " many worthy names have been omitted in order that the story may not lose interest by being overweighted with detail." Even the much larger single-volume histories of medicine cannot hope to be truly comprehensive, so that logically such histories should be one of two kinds, either a short pleasant story, accurately told to be sure, or an exhaustive, encyclopedic treatment in many volumes, as accurate as may be, and admittedly for reference or, at most, fragmentary reading of special topics. Yet, practically, the one large volume that straddles the dilemma is probably the more useful to the medical world.

The shorter narrative provides a background that, to be sure, is far ahead of the average physician's knowledge of the past progress of his profession; yet the more successful it is in whetting the reader's appetite, the more disappointing it becomes in the amount of desired information provided. On the other hand, the many-volumed history—if such a one existed in English—would not only be too expensive to be easily available to many, but also it would be beyond the capacity of any individual to master. If the point needs

further illustration, Sarton's monumental *Introduction to the History of Science* affords it—a life-long work about to be increased to 7 or 8 huge volumes, invaluable as the reference work that it is intended to be, yet usable only as a reference work. The large single volume, then, may be accepted as a useful compromise—instructively readable in the main, yet also furnishing adequate factual data for ordinary purposes. And it should be remembered that it is just in the modern periods (in which young men tend to be most interested) that factual data are most numerous and most likely to be sought after.

Not that anyone wants a mere catalogue of "who did what when"; if a certain amount of this is unavoidable it should at least be segregated from the readable parts by small type, special headings, etc. Dr. Guthrie has certainly avoided a mere chaplet of biographies and a maze of dates and events; he has also undoubtedly presented a consecutive narrative that illustrates the various aspects of the "mosaic of medical history" that he enumerates in his preface. It would be a mistake, however, to assume that even the high spots of medicine in all its branches find inclusion in these brief pages. The whole field of Pediatrics, for instance, except for a page and a half on Renaissance works, is dismissed in one page; modern Ophthalmology in less than three pages; Radiology in one page, modern Public Health in six pages, and so on. Surely the story of Pathology, for instance, is regrettably inadequate when it omits such names as Benivieni, Bonetus, Gaub, Carswell, Hodgkin, Cohnheim, Weigert, von Recklinghausen, Ziegler, Zenker, Aschoff, Welch, Ewing, Whipple—to name but a few; and the same might be cited in other specialties.

One may also, and also inevitably, object to some evaluations. Charles Bell, for instance, to whom four pages are devoted, will appear to few if any as "the greatest medical discoverer since Harvey" (p. 266). One might be tempted to ascribe this disproportionate detail to chauvinism were it not that occasionally favored individuals of other nationalities, such as Paré and John Shaw Billings, for example, are treated with disproportionate generosity. Nor, when the objection is made that important modern progress is neglected, is it an adequate rejoinder to state that modern events are too difficult to evaluate and therefore need not be mentioned. The sulfonamide type of therapeutic agent, and antibodies such as penicillin and streptomycin, though eventually superseded as they doubtless will be, have made sufficient imprint on the medical story to be adequately treated regardless of their ultimate fate.

It appears to the reviewer, then, that much of importance in the story of medicine has, perhaps necessarily, been omitted from this brief but attractive presentation, though as "a historical background to modern medicine" it should achieve its objective of stimulating interest in significant achievements of the past. Under such conditions, Guthrie's and Garrison's books might well have exchanged their titles.

Many of the illustrations are novel and all are interesting. Unfortunately their reproduction falls short of the rest of the book-making. In fact, this appears to be the book's most serious blemish. Textual errors are relatively few: we note, among others, that Agramonte is omitted from Reed's Yellow Fever story; William Penn confused with his son, Thomas; Virchow's discovery of leukemia given as leucocytosis; and Virchow credited with Schleiden and Schwann's cell theory, which could not be said to have been anticipated, as the author states, by Hooke's use, in the seventeenth century, of the word "cell." Such minor details, however, should not be permitted to spoil the reader's interest in a well written valuable contribution.

University of Pennsylvania School of Medicine E. B. KRUMBHAAR

William Beaumont's Formative Years: Two Early Notebooks, 1811-1821. With Annotations and an Introductory Essay by Genevieve Miller. New York: Henry Schuman, 1946. xv+87 pp., illustrated. $6.00.

MORE than a century has passed since William Beaumont made his famous studies on Alexis St. Martin, and still the achievement of this "Backwood Physiologist" continues to intrigue students of American medical history. Although a very large literature has grown up about Beaumont's famous experiments, most of it is filio-pietistic in character and presents little that is in any way original. It is therefore all the more to the credit of Miss Miller that the present volume presents original features of great importance to a proper understanding of the significance of Beaumont's work.

The question has often been raised whether great men make history, or whether historical situations make men great; and the case of William Beaumont seems almost like a crucial experiment to solve this problem. For we see that it is neither one nor the other alone; instead, it is the time, the place, and the man conjoined. A situation being given, a man is free to accomplish within its limits as much as his ability and training will permit him. This we see in the case of William Beaumont. The situation occurred, and the man who was present was ready.

It becomes a matter of great interest therefore to determine what preparation this man had; and this information is furnished to a very great degree by the book under consideration. Two of his early notebooks have been preserved, and these give a glimpse into his medical training and early years of practice. These books contain notes dating from 1811, when Beaumont was still a student, up to 1821 when he first went to Ft. Mackinac, where in the following year he had his rendezvous with fame.

The notes themselves are more eloquent than anything that may be said about them. They are reproduced precisely as they occur in the original. Miss

Miller has done a good job of annotating the notebooks. Wherever possible, she has attempted to identify personalities, and to supply other necessary information. A short introduction places these documents in their proper context. This beautiful little volume, well printed, with a most attractive binding, is an important contribution to the history of American medicine as well as to the literature on William Beaumont.

GEORGE ROSEN

NANCY F. OSBORNE. *The Doctor in the French Literature of the Sixteenth Century*. New York: King's Crown Press, 1946. 140 pp. $2.00.

MISS OSBORNE's interesting little book is a companion-piece to an earlier work on a similar subject by Christine E. Petersen, *The Doctor in French Drama, 1700-1775* (New York, Columbia University Press, 1938). Now, if the Romance Department of Columbia University will sponsor an investigation of the medical aspects of seventeen-century French drama, including a comprehensive analysis in English of Molière's plays, these footnotes to more orthodox histories of French medicine will be without a hiatus.

Miss Osborne discusses the doctor, the apothecary, the charlatan, remedies, cures, and medical practices, quoting extensively from contemporary sources in French which is a little too antiquated for the casual reader. It would not have insulted the reader, nor called in question the abilities and scholarship of the author, had Miss Osborne offered a translation of her source material. For it should not be forgotten that the writings she considers were written in the vernacular, and their authors would be the last to protest had they been presented to modern readers in easy, familiar English dress.

One of the interesting conclusions to be drawn from Miss Osborne's array of quotations is that the literary man looks at physics and physicians through much the same eyes regardless of the condition of the medical art and science of his day. In other words, medical satire on the one hand, and, on the other, the patient's gratitude to the honest physician who heals him, are unchanging. Therapeutics may improve, but the patient's reaction to a nasty dose, or his heirs' approval of the potion which kills him, does not alter with the centuries.

Thus, Miss Osborne's demonstration that the art of medicine was the same in the sixteenth century as in our own is in itself a salutary dose.

HERBERT SILVETTE

ALLEN W. FREEMAN. *Five Million Patients*. New York: Charles Scribner's Sons, 1946. xiii+299 pp. $3.00.

THERE ARE, perhaps, those who feel that there have been too many autobiographies of doctors published within the last few years. *Five Million Patients* is

not just another "doctor book." Dr. Freeman has carefully avoided the pitfalls of many recent autobiographers in the medical field. The account of his experiences from the day he entered medical school until the day he retired as Professor of Public Health Administration is written in the third person, and the author carries this objectivity through to his evaluation of the work of the student, the intern, the assistant health commissioner, the epidemiologist, the major, the commissioner, and the professor.

Dr. Freeman has a gift for writing in an interesting fashion; he had the good fortune to live a very eventful life. The combination makes good reading to the worker in the field of public health particularly.

Dr. Freeman's story deals with a very interesting period in the history of public health. The reviewer remembers a statement of Dr. Freeman's in a lecture many years ago indicating that "modern public health dates from the time that the speaker engaged in public health work," or something to that effect. In Dr. Freeman's case, modern public health practice very nearly, if not quite, did begin with his early efforts in the city of Richmond. There is much of human interest in his account of these early days when public health was getting started in this country.

He was again a pioneer in the development of epidemiological services as a member of the staff of the United States Public Health Service. And he did yeoman work in the development of local health administration as Commissioner of Health in Ohio.

Still searching for fields in which to pioneer, he became the first Professor of Public Health Administration and, without precedent, developed the methods of teaching this subject as an art.

For all of these reasons *Five Million Patients* will be of great interest to everyone in the field of public health. The book, however, is not technical in any sense of the word and will undoubtedly find its largest number of readers among the lay public. It is a pleasant evening's reading for anyone.

The Johns Hopkins University School of
Hygiene and Public Health — Ernest L. Stebbins

George Rosen. *Fees and Fee Bills. Some Economic Aspects of Medical Practice in Nineteenth Century America.* Supplements to the *Bulletin of the History of Medicine,* No. 6. Baltimore: The Johns Hopkins Press, 1946. 91 pp. $1.50.

Dr. Rosen's preliminary investigation into medical costs of the nineteenth century not only is an excellent beginning, but also points the way for more extensive research in a field that has been little tilled. Perhaps Dr. Rosen himself will enlarge his present monograph to the end that it covers more geographic terri-

tory, samples many more fee bills, and, finally, integrates the results with the economic pattern of the century. The author himself says candidly that his study does not pretend to present a complete survey of the economic history of American medicine, but is merely a collection of materials toward such an end. What he has done, is done well. His reprinting of schedules for medical service represents more than twenty societies, ranging from New York through a few of the states of the Old Northwest, to Georgia and Tennessee and on to Washington in the New Northwest. Not enough material has been gleaned from the Pacific slope and the Deep South to warrant any interpretation. Indeed, this reviewer is not convinced that the rates here printed are typical of any region, or that some of them were followed. Frequently, a physician was paid in kind. Other concessions make it difficult for the scholar to accept fee bills as representing what a doctor actually received. Yet the author has provided material which, as he says, may serve as a basis for a thorough study, and for this contribution the researcher in medical economics will be thankful.

University of Minnesota PHILIP D. JORDAN

Bulletin of the Health Organization, League of Nations, Volume X, No. 4, 1943-1944. New York: Columbia University Press (distributor), 1945. $1.20.

IN February 1920, the council of the League of Nations, at its second session, decided to convene an International Conference of Health Experts to draw up a plan for a Health Organization. A scheme adopted in 1923 brought such a Health Organization into being. This organization consisted chiefly of a Health Committee, an Advisory Council (through which liaison was established with the Office International d'Hygiène Publique), and the Health Section of the Secretariat of the League of Nations. The Health Organization operated from 1923 to 1945 and will now be incorporated in the World Health Organization of the U.N.

During this period the Health Organization published a *Bulletin* in which appeared the studies that it carried out. The publication under review is the last issue of the *Bulletin* containing studies undertaken by the Health Organization. (The last volume, XI, 1945, contains only a complete bibliography of the technical work of the Health Organization from 1920 to 1945.)

Volume X, No. 4, contains three studies. Two of these, "Health in Europe" and "Famine Disease in the Internment Camps," are of considerable interest as they deal with contemporary medical history. In the former article, Dr. Biraud surveys the epidemic and nutritional situation of Europe, and produces a preliminary study of the influence of the war and of war conditions on

public health in Europe. The first section of this monograph, a critical analysis of the statistical material available for forming an opinion on the health of Europe, should be read by all historians who attempt to evaluate the role of disease in history.

GEORGE ROSEN

PENICILLIN. *Its Practical Application*. Under the general Editorship of Sir Alexander Fleming. Philadelphia: The Blakiston Company, 1946. x+380 pp. $7.00.

THIS BOOK is divided into two sections, a general and a clinical, containing 6 and 21 chapters, respectively, written by 28 contributors, all from Great Britain. As might be expected in a book written by so many contributors, the quality of the different chapters is highly variable, some being distinctly more valuable than others. The chapters by Fleming himself on "History and development of penicillin" and "Bacteriological control of penicillin therapy" are informative and provocative. The chapters by Porrit and Mitchell on prophylactic use, and use in wounds and gas gangrene are excellent summaries of a very considerable wartime experience, and with the exception of the critical chapter by Christie on bacterial endocarditis, are the best in the clinical section of the book. The chapter by McElligott on venereal diseases is a useful summary, and that by Lovell on "Penicillin in animal diseases" will bring to medical practitioners information that they are unlikely to come across in their usual reading, and will surprise most of them with the scientific approach of modern veterinary medicine.

A wider bibliography and fuller consideration of American experience with penicillin would have improved the volume greatly. For example, American experience in the treatment of empyema is at variance with certain of the opinions cited in the chapters on the use of penicillin in chest infections and chest surgery, and a critical discussion here would have been of great value. Moreover, few American investigators would agree that "the intrathecal injection of penicillin solution . . . is safe and highly effective," or that penicillin is the drug of choice for all cases of meningococcal meningitis. In the chapter on treatment of generalized infections the statement is made that "there is as yet no definite evidence that organisms can become penicillin-resistant," which does not conform with numerous clinical and experimental observations relating especially to staphylococcus, but extending also to other species.

The volume is well printed and contains numerous illustrations.

New York University College of Medicine COLIN MACLEOD

SIR ALEXANDER FLEMING. *Chemotherapy: Yesterday, Today and Tomorrow.* Cambridge: at the University Press. New York: The Macmillan Company, 1946. 39 pp. $.50.

A GOOD part of this lecture is devoted to Fleming's use of the slide cell method for testing potential chemotherapeutic agents in vitro. The author regards his early experiments with this simple method as the most important he has ever done, and justifies this statement by illustrations with a number of antibacterial agents ranging from carbolic acids to the sulfonamides. In the space of 39 pages he has succeeded in touching on many of the most important topics in chemotherapy including the present day trial-and-error investigation of innumerable species of bacteria and molds for new antibiotics, of which methods he is mildly scornful. The latter portion of the lecture is devoted to a plea for establishment in Great Britain of a central institute for fundamental research in microbiology, and an indictment of various governmental agencies for refusing to take up the responsibility for its founding under the excuse "that it is nobody's baby."

New York University College of Medicine — COLIN MACLEOD

SELMAN A. WAKSMAN. *Microbial Antagonisms and Antibiotic Substances.* New York: The Commonwealth Fund, 1945. 350 pp. $3.75.

THE RECENT discovery of the effectiveness of certain antibiotic substances produced by microorganisms, notably penicillin and streptomycin, in treating various human and animal diseases has aroused intense interest in the entire field of microbial antagonisms. Actually, the history of this subject is about as old as that of bacteriology. Since the early days of bacteriology the phenomena of antagonistic interrelations among microorganisms has attracted the attention of research workers. Pasteur and Tyndall made what are probably some of the earliest observations, and De Bary in 1879 was the first to emphasize the significance of the antagonistic interrelations among microorganisms. The history of this subject is still unwritten, but whoever will one day essay this task will be duly grateful to Dr. Waksman for having produced this volume. In it he surveys the subject, including a review of the literature extending back to the time of Pasteur. He discusses the relations among microorganisms living in association, with special attention to the antagonistic effects. The chemical nature of the substances produced by various antagonists is described, and the nature of the antibiotic action as well as its practical application is discussed.

GEORGE ROSEN

CLYDE KLUCKHOHN. *Navaho Witchcraft.* Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University, Vol. XXII, No. 2. Cambridge, Mass., 1944. x+149 pp. $2.25.

IN THIS study Dr. Kluckhohn extends his previous work with the Navaho by dealing intensively with the difficult and elusive subject of witchcraft. The source of his data is the beliefs and reminiscences of contemporary people as collected through interviews with numerous informants, both selected and incidental, during the period from 1923 until the publication of the monograph. Although the informants were widely scattered geographically, the Ramah-Danoffville area near Gallup, New Mexico, is particularly well represented. In his introduction, Dr. Kluckhohn limits himself to a strictly functionalistic approach, avoiding a historical and comparative treatment of the subject, although some comparisons are later made with Puebloan and Apache witchcraft. The presentation consists of three parts, Part I being the assembled and organized facts of his observations, Part II including a theoretical discussion of witchcraft among the Navaho from the viewpoint of social psychology, and Part III consisting of translated interviews and folklore materials.

Part I is of great interest not only to the anthropologist who would like to know the details of Navaho supernaturalism, but also to the more general reader who may be interested in the story of man's attempts to control his milieu and his fellow beings through the pseudo-logic of sorcery, magic, and witchcraft. Of fundamental importance in this presentation is the analysis of types of witchcraft met with among the Navaho. Kluckhohn uses the terms "wichery," "sorcery," "wizardry," and "frenzy witchcraft" with arbitrary denotations to indicate the four principal areas of Navaho malevolent supernatural activity. *Wichery* refers to the practice of inducing sickness, fainting, and a wasting death through a type of poison made from the flesh of corpses, the flesh of twin children being particularly efficacious. *Sorcery* embraces a type of spell-casting which is done at a distance from the victim through pronouncing an incantation over articles of clothing, nail parings, bits of hair, feces, or other material once in contact with the person of the victim in accord with the principle of contagious magic. Songs and formulas are used as the incantation, sometimes "good prayers" being said backward for this purpose. *Wizardry* is the term used for the type of magic which is based on object intrusion, i. e., the injection of some supernaturally charged object such as a stone, bone, or quill into the body of the victim. The mechanics of intrusion commonly involve the use either of a shooting tube or, more often, a special basket or cloth carried through the air by levitation. This type of witchcraft was cured, as elsewhere, by sucking the supernaturally charged missile from the victim's body. Kluckholm believes from his inform-

ant's statements that this form of magic is of recent origin among the Navaho, having developed since the Fort Sumner captivity period of 1863-1867. *Frenzy-witchcraft* deals with the magical aspects of a group of activities the Navaho word for which is construed "Prostitution Way," and which centers around the use of certain plants, especially *Datura,* in love magic or success-bringing procedures for gamblers and traders. The curing of the several types of magic is considered in some detail, the use of different "medicines" being a subject of questioning. Gall medicine, prepared from the gall bladders of the eagle, bear, mountain lion and skunk, is an important ingredient along with maize meal in the antidotes for magical activity. Sand or pollen paintings, plants, scraped rock dust, and song ceremonials are likewise protective and healing devices. An important element in curing is the confession of witchcraft by the witch, usually forced through restraint and starvation. Prayer ceremonials are used to "pray the evil back to the witch," and sucking is done on the victim's body to remove blood or a supposed supernatural object. Current participation in witchcraft is estimated somewhat quantitatively and it is noted that "essentially all Navaho seem to share this fear to some degree, but the intensity of the fear varies greatly from area to area, from individual to individual, and among the same individuals from time to time and from situation to situation." It is further noted that more women than men show anxiety over it and that "the unacculturated Navaho strongly tends to accept the use of supernatural techniques for socially disapproved ends as an inevitable part of the nature of things." Furthermore, the white side of magic is thought of as a social value as in rain-bringing through witchcraft.

Part II of the monograph is subtitled "An essay in structural dynamics," and seeks to examine quite fully the psychological role of witchcraft in Navaho society through analytic methods of the type outlined in Chapple and Coon's *Principles of Anthropology.* The individual's acquisition of witchcraft ideology is described as follows:

> The child, even before he is fully responsive to verbalizations, begins to get a picture of experience as potentially menacing. He sees his parents, and other elders, confess their impotence to deal with various matters by technological or other rational means in that they resort to exoteric prayers, songs and "magical" observances and to esoteric rites. When he has been linguistically socialized, he hears the hushed gossip of witchcraft and learns that there are certain fellow tribesmen whom his family suspect and fear.

For the mature members of society witchcraft satisfies the lust for power among those who have not been able to gratify the desire through the socially approved means of becoming a singer. Among persons who are not witches, the role of the witchcraft pattern is stated, in part, in these terms:

> At the manifest level, it may be pointed out, first of all, that witchcraft stories have

the obvious value of the dramatic—the exciting story. They partially fulfill the "functions" which books and magazines, plays and moving pictures carry out in our culture. In the second place, it must be realized that witchcraft ideology gives a partial answer to the problems which disturb the Navaho as well as other peoples—stubborn illness without apparent etiology, death without visible cause.

Moreover certain persons use the witchcraft pattern as a means of attracting attention to themselves. A considerable proportion of the individuals who show the manifest symptoms of bewitchment such as fainting and falling in trances in public gatherings are "men or women who are somewhat neglected or occupy low status." Again witchcraft provides an emotional adjustment to a people who experience numerous anxieties because of economic insecurity and the growing need for resolving the strains involved in the blending of two cultures. The hostilities born of these anxieties are to a degree sublimated through offering the witch as scapegoat:

To make the broadest possible structural comparison, Navahos blame their troubles on witches instead of upon "Jews" or "niggers." We should be putting the matter oversimply but not altogether incorrectly if we said that a belief in witchcraft was Navaho culture's substitute for "race prejudice." Just as witchcraft practice has the manifest "function" of providing a channel through which direct aggression can be released, so witchcraft belief has the latent "function" of channeling displaced aggression. But in place of selecting its "scapegoats" by the color of their skin or by their separate religious tradition or by their occupation, Navaho culture chooses certain individuals who are supposed to work evil by secret supernatural techniques.

Another role of witchcraft has been to provide means of social control, the fear of witch accusation being a means of keeping potential disrupters of the social order from becoming overt in their activities. The historical incident of 1884, in which the Navaho leader Manuelito caused more than forty "witches" to be killed, is mentioned as a probable use of the witchcraft pattern as a device for quelling uprisings which would have led to hostilities with the United States and disaster for the Navaho people. Other secondary control functions are noted, such as fear of witchcraft as a stimulus to provide for the aged, and fear of witches at night as a deterrent to extra-marital sex relations. In a general way witchcraft fear has fluctuated with the emotional tensions of the Navaho populace, from the Fort Sumner period down to the present. Thus the current period of controversy over the government stock reducing program has been reflected in a resurgence of witchcraft fears and rumors.

The "essay" which forms Part II of this monograph, although at times lacking complete clarity in expression and direction, is a stimulating and enlightening discussion and will doubtless become a pattern for studies in dynamic structural analysis in future ethnological literature.

Part III, the appendices of translated notes and interviews, will be disappointing to some anthropologists because of the absence of Navaho language

texts and the seemingly rather heavy editing of some of the translations. For folklorists and linguists the value of the monograph would have been enhanced immeasurably by the inclusion of such texts in addition to the translations. It is to be hoped that the author may publish these separately in the future.

A few minor criticisms may be voiced concerning the author's choice of terminology for arbitrary definition. The term "witch" is applied to male practitioners. Although etymologically justifiable, this usage violates the traditional restriction of the term to female adepts in the black art and might cause misinterpretation of parts of the work read out of context. Certain other terms might be criticized on similar grounds, although it must be stressed that the author fully defines his terminology at the outset. Also an objection might be raised to the author's employment of concepts without explanation which might not be familiar to the person without a background in ethnological reading, but this deficiency is largely remedied through generous documentation.

San Diego State College SPENCER L. ROGERS

PAUL RADIN. *The Road of Life and Death: A Ritual Drama of the American Indians.* With a Foreword by Mark Van Doren. The Bollingen Series V. New York: Pantheon Books Inc., 1945. xiv+345 pp. $4.50.

PAUL RADIN, the noted American anthropologist, had made available in this volume a translation of the Medicine Rite of the Winnebago Indians of Wisconsin whom he visited during 1908-1909. The value of the text is further enhanced by an illuminating introductory essay in which he provides a complete account of the interesting circumstances in which he succeeded in obtaining the unusually complete record and interpretation of this secret lore from his Indian informants, together with a philosophical and historical analysis of Winnebago culture. A Prologue containing excerpts from the autobiography of *Crashing-Thunder* (previously published), a description of three reincarnations provided by the latter's brother-in-law, the Origin Myth of the World, and finally a description of the ghost's journey to a spiritland, provides an authentic introduction and background for the ritual drama. The actual text of the drama is difficult reading, notwithstanding Dr. Radin's helpful notes, since so much of it is filled with mythological references and repetitious speeches and "greetings to ancestors."

One must turn to Dr. Radin's earlier work on *Primitive Religion* (1937) for an explanation of what is meant by "ritual drama" and for a brief analysis of the Winnebago Medicine Rite. There we are informed that the term "drama" as used in this connection refers to

> the performance of a ritual belonging to a clearly defined non-public organization, in other words, to some society or club whose membership is restricted; and secondly, to such

rituals as are theoretically supposed to be re-enactments of a particular series of events generally embodied in a myth or myth-poem and in which specific individuals or groups definitely impersonate the original actors (289).

A ritual drama is, in brief, a symbolic, esoteric enactment of a myth for the purpose of obtaining some practical benefits for the participants. In the case of the Winnebago Medicine Rite, the "one basic theme" is "the proper method of passing through life in order to be reborn again" (304).

The Winnebago, according to Dr. Radin, distinguish clearly between *worak and waika,* between what is regarded as a true or factual account of human adventures on the one hand, and sacred, superhuman epics on the other (54). The Medicine rite is to be understood as a human re-enactment of a superhuman or metaphysical epic for the purpose of enabling man to participate so far as possible in the divine prerogatives of immutability, foreknowledge, and immortality. Earthmaker, the supreme deity of the Winnebago, is represented as withholding tobacco from the spirits or lesser gods who have an insatiable craving for it in order to present it to man as a medium of exchange wherewith he may obtain blessings of power and life from the deities. Man is thus enabled to transcend death by means of successive reincarnations, provided he lives in accordance with a specific ethical code and gives the gods their due in the ritual drama of the medicine rite.

Dr. Radin recounts that he was favored in obtaining a complete record of this most secret and sacred Winnebago rite through the sacrificial cooperation of an Indian informant called Jasper Blowsnake, a convert to the competing religion of the peyote-eaters, who together with other members of the cult was interested in dealing a death-blow to the cult of the "pagans." It would appear, therefore, that the devotees of the narcotic peyote cult triumphed temporarily over the adherents of the tobacco cult, only to suffer a similar fate themselves within the next twenty years. In the meantime this combination of strange events has enabled Dr. Radin to obtain a valuable record of genuine significance not only for the history of religion and religious acculturation but also for an understanding of the perennial philosophical issues which confront the thinking members of all historical human societies. One can not help wondering why the author delayed so long in publishing his material.

The Viking Fund, New York City. DAVID BIDNEY

Journal de la Société des Océanistes, Vol. 1, No. 1. Paris: Musée de l'Homme, December 1945. 234 pp. Frs. 300.

In 1944 the Groupe d'Études Océaniennes du Musée de l'Homme, and the Société des Océanistes joined in Paris to form a new Société des Océanistes. The president of the society is Maurice Leenhardt, the successor of Marcel

Mauss at the École des Hautes Études, the secretary general Father Patrick O'Reilly; both men are well known for their ethnographical work in the Pacific. The Society publishes a new journal, *Journal de la Société des Océanistes,* the first number of which has just reached this country. The *Journal* is extremely well done, and perusal and subscription are highly recommended to all those interested in the problems of the Pacific. The first number covers such different aspects as ethnology (an article on New Caledonian masks by Leenhardt, and one on exchange in New Caledonia by Pierre Métais), archeology (Tasmanian paleolithic by Henri Breuil), physical anthropology (soft parts in New Caledonians by Pales and Chippaux), museology, ornithology, recent political history, and aviation in the Pacific. The *Journal* also carries an excellent book review section, and a splendid bibliography, composed by Eduard Reitman, covering the years 1939-1944; it will be most welcome here to fill gaps in our knowledge caused by wartime isolation.

The University of Wisconsin ERWIN H. ACKERKNECHT

AGNES ARBER. *Goethe's Botany.* Chronica Botanica 10: 63-124. Waltham, Mass., The Chronica Botanica Co.; New York: G. E. Stechert and Co., 1946. $2.00.

TODAY it requires a certain amount of courage to attempt to contribute to our knowledge of the much studied and many sided Johann Wolfgang von Goethe. Even the minor avocations of this genius have been subjected to the detailed investigations and analyses of Teutonic scholarship. Dr. Arber, however, was not intimidated and has, at the very least, made an exceptionally clear and precise evaluation of Goethe's major scientific interest. Goethe had an amateur but practical acquaintance with forestry, something more than an amateur's knowledge of the Linnean system, and a real philosophical interest in mutation and development. His *Metamorphosis of Plants* is an important contribution to botany, and would undoubtedly have been appreciated, even if its author were not famous in other fields.

Dr. Arber's short essay on Goethe as a botanist is followed by her new translation of his *Versuch die Metamorphose der Pflanzen zu Erklären.* The publication of this translation in *Chronica Botanica* is a real service to those who would like to have their students acquainted with the history of botany, for this English edition is now available in botanical libraries and students can be directed to Goethe's own work. The fragment, *Ode to Nature,* is included in both German and English. It was probably written by Tobler, but Tobler was certainly influenced in its composition by Goethe. At any rate we can be sure that Goethe was in harmony with its philosophical attitude. All in all Dr. Arber has produced a most interesting and attractive brochure.

University of Pennsylvania CONWAY ZIRKLE

RICHARD EAGER. *The Treatment of Mental Disorders (Ancient and Modern)*. Exeter: H. K. Lewis & Co., 1945. 100 pp.

THE TITLE of this book is misleading. Its short historical account (18 pages) of the treatment of the insane in the British Islands is followed by the history of the Devon County Lunatic Asylum founded in 1845. Unfortunately, like so many booklets on mental hospitals, more space is devoted to the history of material transformations than to the biographies and ideas of the doctors who animated the cures. This is especially regrettable here since one of the doctors was Dr. J. C. Bucknill, editor of the first number of *The Asylum Journal* which became in 1858 the *Journal of Mental Science* and in 1863 *The Journal of the Medico-Psychological Association*. John Bucknill died in 1938 at the age of 98 and we regret to find so little about his long career.

New York City RAYMOND DE SAUSSURE

Parergon Supplement. Evansville, Indiana: Mead Johnson & Co., 1946. 32 pp.

THIS supplement to Parergon, the well known illustrated book on works of art produced by physicians, contains essentially a series of excellent short bibliographies on all those items important to doctors who want to get started in one branch of the arts and crafts: drawing, painting, graphic arts, silk screen, photography, sculpture, metal work, pottery, wood work, etc. The five officers of the American Physicians Art Association have each contributed a short encouraging and instructive article. The whole forms a useful and entertaining little pamphlet.

The University of Wisconsin ERWIN H. ACKERKNECHT

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